

Substance Use Disorders and HIV (Last updated July 10, 2019; last reviewed July 10, 2019)

Key Considerations and Recommendations

- Substance use disorders (SUDs) are prevalent among people with HIV and contribute to poor health outcomes; therefore, screening for SUDs should be a routine part of clinical care **(AII)**.
- The most commonly used substances among people with HIV include alcohol, benzodiazepines, cannabinoids, club drugs, opioids, stimulants (cocaine and methamphetamines), and tobacco.
- Health care providers should be nonjudgmental when addressing substance use with their patients **(AIII)**.
- Persons with HIV and SUDs should be screened for additional mental health disorders **(AII)**.
- Persons with HIV and SUDs should be offered evidenced-based pharmacotherapy (e.g., opioid agonist therapy, tobacco cessation treatment, alcohol use disorder treatment; see [Table 13](#)) as part of comprehensive HIV care in HIV clinical settings **(AI)**.
- Ongoing substance use is not a contraindication to antiretroviral therapy (ART) **(AI)**. Persons who use substances can achieve and maintain viral suppression with ART.
- Substance use may increase the likelihood of risk-taking behaviors (e.g., risky sexual behaviors), the potential for drug-drug interactions, and the risk or severity of substance-associated toxicities (e.g., increased hepatotoxicity or an increased risk of overdose).
- Selection of ART regimens for individuals who practice unhealthy substance and alcohol use should take potential adherence barriers, comorbidities which could impact care (e.g., advanced liver disease from alcohol or hepatitis viruses), potential drug-drug interactions, and possible adverse events associated with the medications into account **(AII)**.
- ART regimens with once-daily dosing of single-tablet regimens, high barriers to resistance, low hepatotoxicity, and low potential for drug-drug interactions are preferred **(AIII)**.

Rating of Recommendations: A = Strong; B = Moderate; C = Optional

Rating of Evidence: I = Data from randomized controlled trials; II = Data from well-designed nonrandomized trials or observational cohort studies with long-term clinical outcomes; III = Expert opinion

Background on Substance Use Disorders among People with HIV

Ending the HIV epidemic requires addressing substance use among people with HIV, which poses a barrier to optimal engagement in the HIV care continuum. Ongoing substance use may prevent an individual from being tested for HIV, initiating antiretroviral therapy (ART), or adhering to ART, and it may increase the frequency of behaviors that put a person at risk for HIV transmission. Substance use may increase the likelihood of risk-taking behaviors (e.g., risky sexual behaviors, needle sharing, and injection of substances), the potential for drug-drug interactions, and the risk or severity of substance-related toxicities (e.g., increased hepatotoxicity and increased risk of overdose). In the United States, the death toll for drug overdose (70,237 deaths in 2017)¹ now far exceeds the death toll for HIV (15,807 deaths in 2016).² As the drug overdose epidemic continues to expand, health care providers need to have a basic understanding of how to screen for and treat substance use disorders in persons with HIV in clinical settings.³

Substance use exists on a continuum from episodic use to a substance use disorder (SUD) with its concomitant negative consequences. Research on alcohol consumption has defined a threshold at which consumption does not reach a diagnosis of a SUD, but where the level of consumption is nonetheless hazardous to the person. This level of consumption has been defined as “hazardous drinking.” A comparable category does not exist for other substances. The prevalence of substance use and SUDs is higher among people with HIV than among the general public,⁴ and polysubstance use is common. This section will focus on the most commonly used substances among people with HIV: alcohol, benzodiazepines, cannabinoids, club drugs,⁵ opioids, stimulants (cocaine and methamphetamines), and tobacco.

Persons with HIV may use more than one substance and may not be ready to consider reducing the use of substances or seeking treatment for SUDs. Polysubstance use occurs for multiple reasons, including to

improve the euphoria associated with use (e.g., use of cocaine and heroin mixtures called “speedballs”) and to reduce the adverse effects of a particular substance (e.g., the use of alcohol or benzodiazepines to reduce the anxiety caused by cocaine use).

Substance Use and Sexual Risk Taking

There is a growing body of literature describing the intersection of substance use and sexual risk taking (“chemsex”). While a precise definition of “chemsex” is lacking, and the various studies have investigated the use of many different substances, this research highlights the impact of substance use on sexual risk behaviors. In these settings, substances may be used to enhance sexual pleasure, decrease inhibitions related to particular sexual acts, and combat low self-esteem. In a retrospective study in a London sexual health clinic, individuals who disclosed substance use (463 of 1,734 patients) had higher odds of acquiring new HIV infection, bacterial sexually transmitted infections (STIs), and/or hepatitis C virus (HCV).⁶ A much larger analysis using the European Men Who Have Sex with Men (MSM) Internet Survey, which collected data from 16,065 United Kingdom-based respondents, found that MSM who reported using methamphetamines or gamma-hydroxybutyrate (GHB) during the previous year were more likely to have gonorrhea infection than MSM who did not use these drugs, with odds ratios of 1.92 and 2.23, respectively.⁷ These data emphasize the need to screen patients for substance use and STIs in clinical settings.

Screening for Substance Use Disorders

Screening for SUDs should be incorporated into the routine clinical care of all persons with HIV. The following questions can be used to screen for drug or alcohol use: “How many times in the past year have you used an illegal drug or used a prescription medication for nonmedical reasons?” and “How many times in the past year have you had X or more drinks in a day?” (X is five for men and four for women).⁸ Data are lacking on the appropriate threshold for alcohol use among transgender individuals, so until data clarifies the risks, providers should use the more conservative threshold of four drinks. Individuals with liver disease, including active HCV infection, should not consume alcohol. A positive response of at least one time on either screen should prompt additional screening with other short, yet effective screening tools (see the [Screening and Assessment Tools Chart](#) from the National Institute on Drug Abuse). These tools can identify substance use and guide decisions on appropriate treatment interventions. There is currently not enough data to determine how often patients should be screened for SUDs; however, given the potential negative impact that SUDs may have on persons with HIV, it is advisable to ask these questions during every clinical visit.

Health care providers should be nonjudgmental when discussing substance use with their patients. Patients who experience stigma or who feel judged may not trust the health care provider’s recommendations, may avoid returning to see that provider again, and may consequently have poorer health outcomes.⁹ Language is one way in which stigma is communicated, and words such as “addict” and “dirty urine” convey a negative connotation. The Office of National Drug Control Policy (ONDCP), the American Medical Association, the American Society of Addiction Medicine, the International Society of Addiction Journal Editors, and others have recommended the adoption of clinical, non-stigmatizing language for substance use as described in the [“Changing the Language of Addiction”](#) report from ONDCP.

Co-Occurring Mental Illness

Many people who use substances have co-occurring mental health disorders, including a history of trauma that may drive and/or exacerbate their substance use. Conversely, ongoing use of substances can place individuals at risk of trauma, such as sexual assault and sexual exploitation, which may further exacerbate their substance use.^{6,10} People with SUDs should undergo evaluation and treatment for concurrent mental health disorders using standardized screening instruments (e.g., the [Patient Health Questionnaire-2](#) [PHQ-2] for depression).¹¹ Where applicable, clinicians should use available behavioral and pharmacological interventions to address mental health concerns, because recommending that patients stop their substance use without providing treatment for underlying mental health conditions has very limited efficacy.¹¹

Several behavioral interventions have shown promise in randomized trials. Motivational interviewing, cognitive behavioral therapy, or a combination of the two have led to decreases in stimulant use, decreases in risky sexual behaviors, and improved adherence to ART.¹² Contingency management, a behavioral intervention that provides rewards for abstinence, has been shown to be effective in decreasing stimulant use among persons with HIV, but the sustained effects of this intervention are less clear.¹³

Selecting and Initiating an Antiretroviral Therapy Regimen

Ongoing substance use is not a contraindication to prescribing ART. Indeed, ART reduces the risk of HIV transmission to sexual and drug-using partners. These clinical, community, and individual benefits should encourage health care providers to initiate ART in people with HIV who use substances, and for those with SUDs.

When selecting ART regimens for individuals who use substances, clinicians should consider potential barriers to adherence (see [Adherence to the Continuum of Care](#)), co-morbidities that could impact care (e.g., advanced liver disease from alcohol or HCV), potential drug-drug interactions, and possible adverse events that are associated with the medications. Providers should discuss adherence with their patients during multiple, nonjudgmental evaluations. In general, the use of simplified ART regimens should be considered to aid ART adherence. Regimens for people with SUDs should be easy to take, such as a once-daily, single-tablet regimen,¹⁴ and have a high barrier to resistance or a low risk of hepatotoxicity. Adherence counseling should highlight the benefits of ART use, irrespective of concurrent substance use. Additionally, a reduction in substance use may improve adherence to ART.¹⁵

Commonly Used Substances and Their Impact on HIV and Antiretroviral Therapy

Health care providers should have a basic understanding of evidence-based treatments for SUDs, including alcohol, benzodiazepines, cannabinoids, club drugs, opioids, stimulants (cocaine and methamphetamines), and tobacco. The sections below discuss the impact of these substances on persons with HIV and how these substances affect ART use.

Alcohol

Epidemiology

Alcohol consumption is common among persons with HIV. Recent estimates indicate that >50% of persons with HIV in the United States consume any amount of alcohol (with a range of 54% to 67%).^{16,17} Among a sample of persons with HIV across seven university-based HIV clinics in the United States, 27% of people screened positive for unhealthy alcohol use as determined by the Alcohol Use Disorders Identification Test-Consumption (AUDIT-C).¹⁷ Unhealthy alcohol use includes a spectrum of consumption, including risky or hazardous use, heavy episodic use (binge drinking), and alcohol use disorder (AUD).¹⁸

Risk-Taking Behaviors, the HIV Care Continuum, and Comorbidities

Unhealthy alcohol use has been linked to HIV acquisition, as unhealthy alcohol use can increase the frequency of behaviors that put a person at risk for sexual transmission of HIV.¹⁹⁻²¹ In a meta-analysis of 27 studies, any alcohol use, unhealthy alcohol use, and alcohol use in sexual contexts were all associated with condomless sex among persons with HIV.²⁰

In addition, unhealthy alcohol use has been associated with interruptions in all steps of the HIV care continuum, including lower adherence to ART.^{22,23} Studies have demonstrated both temporal and dose-related relationships between alcohol use and adherence, where ART is more likely to be missed on a given drinking day and the day after drinking, with a stronger association on heavy (binge) drinking days.²⁴⁻²⁶ The negative impact of unhealthy alcohol use on ART adherence is likely multifactorial and driven by the effects of intoxication, ART regimen complexity, and patient perceptions of adverse interactions between alcohol and ART drugs.²⁷⁻²⁹ Studies have also demonstrated an association between unhealthy alcohol use

and the loss of durable viral suppression,^{30,31} greater time spent with a viral load >1,500 copies/mL after ART initiation,³² increased risk of viral rebound, lower retention in care,^{33,34} and increased mortality.³⁵⁻³⁷ Unhealthy alcohol use alone (hazardous or AUD) and in combination with other common comorbidities, including viral hepatitis coinfection, can hasten liver fibrosis progression in persons with HIV.^{38,39} Finally, in general medical populations, unhealthy alcohol use complicates the management of diabetes mellitus, hypertension, mental health disorders, other substance use, and other chronic diseases and increases the risk for pneumonia, osteoporosis, a number of cancers (e.g., liver, head and neck, and breast cancers), and tuberculosis.

Management of Unhealthy Alcohol Use

On-going alcohol use is not a contraindication for a person to receive ART. However, treatment for unhealthy alcohol use may further improve HIV treatment outcomes. Behavioral treatments for unhealthy alcohol use among persons with HIV demonstrate a small but significant reduction in alcohol use⁴⁰ (see additional resources for alcohol management from the [National Institute on Alcohol Abuse and Alcoholism](#) and the [American Public Health Association](#)). Pharmacotherapy can also reduce alcohol use among persons with HIV. There are three Food and Drug Administration (FDA)-approved pharmacotherapies for AUD: naltrexone, disulfiram, and acamprosate (see [Table 13](#)).

Clinical trials have demonstrated the efficacy of naltrexone in reducing the number of heavy drinking days among those with HIV and among the general population. Naltrexone appears to be safe to use in persons with HIV,^{41,42} and it is not associated with significant drug-drug interactions or irreversible hepatotoxicity. However, it is not recommended for individuals with decompensated liver disease and should be used with caution in individuals with elevated transaminase levels. Use of naltrexone in persons with HIV and AUD can improve HIV treatment outcomes. In a randomized placebo-controlled trial of 100 prisoners with HIV who met the criteria for AUD, individuals who were provided depot naltrexone upon release from prison were more likely to achieve viral suppression at 6 months than the placebo group (56.7% vs. 30.3%).⁴²

Data on the use of disulfiram and acamprosate among persons with HIV are lacking. Notably, integrating treatment for AUD with treatment for HIV has been shown to increase the number of patients who receive alcohol treatment medication, counselling, and formal outpatient alcohol treatment services. Integrating these treatments may also improve the likelihood that a patient will achieve viral suppression on ART. A randomized controlled trial of 128 individuals with HIV and AUD compared an integrated stepped-care model of alcohol treatment in Veteran's Administration HIV clinics to treatment as usual. At end of treatment (24 weeks), integrated stepped care resulted in more participants receiving pharmacotherapy for AUD and participating in counseling. Though differences in alcohol use and viral suppression were not seen at 24 weeks, at 52 weeks integrated stepped care was significantly associated with an increased number of alcohol abstinent days, a decrease in the number of drinks per drinking day, and a decreased number of heavy drinking episodes. In addition, the patients in the stepped care group had increased odds of achieving viral suppression (odds ratio [OR] 5.58; 95% confidence interval [CI], 1.11–27.99).⁴³

Liver cirrhosis, whether related to chronic heavy alcohol use, viral hepatitis, or nonalcoholic fatty liver disease, can result in altered metabolism of antiretroviral (ARV) drugs. For those who have hepatic impairment due to alcohol-related liver disease, ART dosing should follow the recommendations in [Appendix B, Table 10](#), which are based on Child-Pugh classifications.

Benzodiazepines

Epidemiology

While specific epidemiologic data on the prevalence of benzodiazepine use among persons with HIV are limited, the use of benzodiazepines can impact both morbidity and mortality. Benzodiazepines cause anterograde amnesia, defined as difficulty recalling events after taking the medication. Individuals do not develop tolerance to this neurocognitive effect, and long-term use of benzodiazepines may result in impairment of neurocognitive functioning.⁴⁴

Risk-Taking Behaviors and the HIV Care Continuum

People who inject drugs and who also use benzodiazepines engage in riskier behaviors than the people who inject drugs but who do not use benzodiazepines; these behaviors may include paying for sex, sharing injection equipment with more people, and performing more frequent injections.⁴⁵ A cohort of 2,802 people who injected drugs was followed from 1996 to 2013. During that time, benzodiazepines were the substances with the greatest association with mortality.⁴⁶ The long-term neurocognitive impact of benzodiazepines on ART adherence among persons with HIV is unclear, but prescribing a memory-impairing medication to persons with HIV who are prone to neurocognitive impairments from other causes increases the risk of poor ART adherence.⁴⁷ Benzodiazepines are also used illicitly to counteract the negative side effects of stimulants such as cocaine and methamphetamine.⁴⁸

Management of Benzodiazepine Use

Repeated use of benzodiazepines can result in physiologic dependence and life-threatening withdrawal in some patients. When feasible, individuals who chronically take benzodiazepines should be slowly tapered off the benzodiazepines under the supervision of an experienced clinician. Different benzodiazepines have different potencies (e.g., alprazolam is more potent than diazepam) and therefore require different tapers in terms of length and graduated decrease in dosage.

Benzodiazepine and Antiretroviral Drug Interactions

Several pharmacological interactions with ARV drugs have also been described. For example, some benzodiazepines are cytochrome P (CYP) 3A4 substrates; thus, when these benzodiazepines are used with a ritonavir-boosted or cobicistat-boosted ARV drug, their half-lives and concentrations can increase significantly, leading to enhanced and prolonged sedating effects. See [Drug-Drug Interactions](#) for available data on benzodiazepine-related interactions.⁴⁹

Cannabinoids

Epidemiology

Both medical and recreational cannabis (marijuana) use are prevalent among people with HIV.⁵⁰ Cannabis belongs to a class of compounds that activate cannabinoid receptors. This class, known as cannabinoids, also includes synthetic compounds such as K2. In recent years, cannabinoids have become more popular. In 2009, two cannabinoids were reported to the National Forensic Laboratory Information System. By 2015, 84 compounds had been reported.⁵¹ These compounds most commonly cause tachycardia, agitation, and nausea, but they have a wide range of psychiatric effects, including psychosis and paranoia.⁵²

Risk-Taking Behaviors and the HIV Care Continuum

Cannabis has not been shown to negatively impact adherence to ART or a patient's ability to achieve viral suppression. In one study, among 874 persons with HIV, daily cannabis use did not predict lower odds of ART use or achieving an undetectable HIV RNA level, except when combined with binge drinking.⁵³ Data from the Multicenter AIDS Cohort Study have supported the idea that marijuana use does not predict problems with adherence to ART or achieving viral suppression.⁵⁴ In some cases, however, cannabinoids have been listed as the cause of death in overdoses. While data are lacking among adults with HIV, the nationally representative 2015 Youth Risk Behavior Survey (which includes data from 15,624 adolescent students in grades 9 to 12) found that students who had ever used synthetic cannabinoids engaged in riskier activities, including sex, than students who only used marijuana.⁵⁵ While the available data suggest that the use of marijuana is not associated with decreased adherence to ART,⁵⁶ data are currently lacking on the impact of synthetic cannabinoids on ART adherence. Finally, with the growing use of synthetic cannabinoids, there is concern that fentanyl could be added to these products, which may increase the risk of opioid overdose.

Management of Cannabinoid Use

Due to the aforementioned concerns regarding cannabinoid use—particularly the variety of compounds and neuropsychiatric effects—persons with HIV should be discouraged from using cannabinoids until more data are available. There is no pharmacological treatment for cannabinoid use disorder; however, behavioral health treatment may be effective for some patients.⁵⁷⁻⁵⁹

Club Drugs

Epidemiology

Club drugs are recreational substances that have euphoric or hallucinogenic effects, or that are used to enhance sexual experiences.⁵ The use of multiple club drugs or other drugs simultaneously is common. While these substances are used by many different persons with HIV, the majority of data comes from MSM with HIV. Use of club drugs in this population has been shown to negatively impact HIV treatment.⁶⁰ Club drugs include methylenedioxymethamphetamine (MDMA), GHB, ketamine, benzodiazepines (see the benzodiazepine section above), and other drugs that are used to enhance the sexual experience (e.g., mephedrone, inhaled nitrates [poppers], and phosphodiesterase-5 inhibitors [PDE5] for erectile dysfunction). Survey data from users of club drugs have also revealed that efavirenz is purchased by people without HIV for its intoxicating effects.⁶¹

Risk-Taking Behaviors and the HIV Care Continuum

Club drugs have disinhibitory effects. Using club drugs increases the likelihood that a person will engage in high-risk sexual practices, which can increase the risk of HIV transmission. In addition, these disinhibitory effects can lead to poor ART adherence.^{49,60,62}

Management of Club Drug Use

Treatment strategies for club drug use have not been well studied in controlled trials.⁶³ There are no recommended pharmacotherapies at this time, and the most common strategy for treating patients who use club drugs is to employ the behavioral interventions that are used for other drug use disorders.

Club Drug and Antiretroviral Drug Interactions

MDMA, GHB, ketamine, and methamphetamine all have the potential to interact with ARV drugs because they are metabolized, at least in part, by the CYP450 system.^{49,62} Overdoses secondary to interactions between the club drugs (i.e., MDMA or GHB) and protease inhibitor-based ART have been reported.⁴⁹ For instance, using PDE5 or ketamine concurrently with potent CYP3A4 inhibitors such as ritonavir or cobicistat can lead to potentiation of the effects of these substances.⁶⁰

Cocaine

See the discussion in the section on stimulants below.

Opioids

Epidemiology

Opioids remain a significant concern for persons with HIV, both for the acquisition of HIV (as recently demonstrated in Scott County, Indiana⁶⁴) and as major contributors to morbidity and mortality. Overdose involving opioids is the leading cause of accidental death in the United States.⁶⁵ The appropriate use of opioids while caring for people with HIV and chronic pain is an important component of combating the opioid epidemic, but this subject is beyond the scope of this section. Please refer to additional resources, such as those from the [Centers for Disease Control and Prevention \(CDC\)](#) and the [Infectious Diseases Society of America](#).⁶⁶ To combat the opioid overdose epidemic, health care providers should prescribe naloxone for opioid overdose prevention for all patients who are using opioids beyond the short-term treatment of acute pain.³

Risk-Taking Behaviors and the HIV Care Continuum

Many people who use opioids start by using opioid tablets (e.g., oxycodone) that are ingested orally or crushed and sniffed. Once tolerance develops, some individuals move from sniffing the crushed tablets to injecting heroin purchased on the streets. This transition from sniffing to injecting dramatically increases the risk of HIV and HCV infection.

Low-cost heroin is often a mix of heroin and higher potency synthetic opioids, such as fentanyl.⁶⁵ Methamphetamines and cocaine have also been combined with fentanyl, but at a lower rate than heroin.^{67,68} With the growing use of synthetic cannabinoids, there is concern that fentanyl could be added to these as well. In all instances where fentanyl or other high-potency opioids are added to other drugs, the risk of overdose increases.

While treatment for an opioid use disorder can improve HIV treatment outcomes, it is not a prerequisite for treating HIV, as some patients are able to successfully adhere to ART despite ongoing opioid use. Although ART coverage among people with HIV who injected drugs increased from 58% to 71% between 2009 and 2015, additional work is needed to improve ART coverage in this population.⁶⁹ Data from the Johns Hopkins HIV Clinical Cohort (2001–2012) demonstrated that in the early years of the cohort, people who injected drugs were less likely to be retained in care; however, this gap in retention had closed by 2012, and people who injected drugs and noninjectors had similar probabilities of being on ART and having a suppressed viral load during the later years of the cohort.⁷⁰

Management of Opioid Use

There are three FDA-approved medications for the treatment of opioid use disorder that can help decrease or eliminate opioid use, reduce the risks of morbidity and mortality that are associated with opioid use, and improve HIV treatment success. These medications, collectively termed medication-assisted treatment (MAT), include buprenorphine, methadone, and naltrexone (see [Table 13](#)). Buprenorphine and methadone are opioid agonists (the use of these drugs is termed opioid agonist therapy [OAT]), while naltrexone is an opioid-antagonist or “blocker.” Both buprenorphine and naltrexone can be prescribed in the setting of routine HIV clinical care.⁷¹ Prescribing buprenorphine requires specific training and licensure (known as an X-waiver; see the [Substance Abuse and Mental Health Services Administration \[SAMHSA\]](#) website for more information). Methadone must be prescribed through a licensed opioid treatment program (OTP). An [OTP directory](#) can also be found on the SAMHSA website.

Use of buprenorphine or methadone can lead to reductions in risky behaviors associated with HIV transmission, psychosocial and medical morbidity related to opioid use disorder, and criminal behaviors. People who are receiving treatment for opioid use are already engaging with the health care system; therefore, they are more likely to initiate treatment for HIV and to be adherent to their ART regimens. Both buprenorphine and methadone are cost-effective interventions at the societal level.⁷² Methadone has better retention in SUD treatment than either buprenorphine or naltrexone, and it should be considered for individuals who do not achieve successful outcomes with buprenorphine or naltrexone.⁷³ Buprenorphine has a lower risk of overdose than methadone. In addition, it can be prescribed in primary care offices. Patients who are taking buprenorphine have significantly better retention in treatment than those who are taking daily oral naltrexone.⁷⁴ While several randomized, controlled clinical trials have demonstrated efficacy for naltrexone when treating opioid use disorder, subsequent study results have been disappointing; one meta-analysis revealed that oral naltrexone was equivalent to placebo.⁷⁵ To address the adherence challenges with naltrexone, a depot formulation was created for monthly administration. This preparation has the potential to improve adherence; however, studies that compare opioid agonists such as buprenorphine and methadone to depot naltrexone as treatments for opioid use disorder have not been conducted. In a randomized, placebo-controlled trial in persons with both HIV and opioid use disorder, participants who received at least three doses of depot naltrexone prior to discharge from prison achieved longer periods of continuous abstinence

after transitioning from prison to the community than those who received either placebo or two or less doses of depot naltrexone.⁴² On the basis of these data, methadone or buprenorphine are generally used as first-line agents for the treatment of opioid use disorder. Depot naltrexone is used as an alternative treatment for people who have recently been released from correctional facilities when other options are not available.

Important pharmacokinetic interactions between these medications (particularly methadone) and certain ARV drugs are listed in [Drug-Drug Interactions](#).

Stimulants

Epidemiology

Cocaine and methamphetamine are powerful stimulants that have been associated with multiple detrimental effects to people with HIV, including accelerated disease progression, poor ART adherence, and lack of viral suppression. Cocaine powder is snorted or injected, while the free-base form (crack) is smoked. Methamphetamines can be taken orally or rectally, injected, or smoked. Cocaine and methamphetamine are commonly used with other substances, including alcohol. Individuals who use stimulants experience a sense of euphoria and may have heightened sexual desire and arousal. This can lead to disinhibited sexual behaviors, increasing the risk of HIV transmission.

The prevalence of stimulant use among people with HIV has been estimated to be 5% to 15% across multiple studies.⁷⁶⁻⁷⁸ Methamphetamine use is more common among MSM,⁷⁹ and increased rates of cocaine use have been observed among ethnic and racial minorities and persons with a history of incarceration.⁸⁰

Risk-Taking Behaviors and the HIV Care Continuum

There are multiple negative health consequences of stimulant use among persons with HIV, including rapid development of dependence and adverse effects on multiple organ systems, particularly the central nervous and cardiovascular systems. Stimulant use is associated with neurocognitive impairment,⁸¹ delirium, seizures, hemorrhagic strokes, and mental health disturbances, including anxiety, psychosis, and paranoia.

Stimulant use may independently lead to HIV disease progression even among persons who are taking ART and who have achieved viral suppression. Research to identify the cellular mechanisms responsible for this is ongoing, but increased viral replication, direct effects on the immune system that lead to declines in CD4 T lymphocyte cell count, enhanced immune activation, and disruption of the blood brain barrier that facilitates HIV entry into the brain have been implicated.⁸²⁻⁸⁵ Stimulant use has been associated with poor HIV continuum of care outcomes, including suboptimal rates of ART adherence, retention in care, and viral suppression. Lack of viral suppression, combined with the increased likelihood of risky sexual behaviors that occurs under the influence of stimulants, poses a threat to the HIV treatment as prevention paradigm.⁸⁶

Non-opioid substances, including methamphetamines and cocaine, are sometimes combined with fentanyl, which increases the risk of overdose.^{67,68}

Management of Stimulant Use

Several pharmacologic and behavioral interventions for stimulant dependence have been investigated, and some trials have included people with HIV. The results of pharmacologic interventions have generally been disappointing. There is no FDA-approved pharmacotherapy for cocaine use disorder at this time, despite research on multiple drug classes, including antidepressants, antipsychotics, anticonvulsants, and dopaminergic medications (e.g., disulfiram).^{87,88} Among persons with HIV who use crack and opioids, MAT for opioid use disorder may improve ART adherence and viral suppression.^{89,90} There is limited evidence that some pharmacologic interventions (e.g., methylphenidate, modafinil, bupropion, naltrexone)⁹¹ can reduce methamphetamine use or cravings, yet there is no recommended pharmacotherapy to treat stimulant use disorder in persons with HIV.

Several behavioral interventions have shown promise in randomized trials. People with HIV who received

motivational interviewing sessions, cognitive behavioral therapy, or a combination of the two decreased their stimulant use and improved their adherence to ART, and they were less likely to engage in risky sexual behaviors.¹² Contingency management has been shown to be effective in decreasing stimulant use among persons with HIV, but the sustained effects on the reduction of stimulant use and improvements in ART adherence are less clear.^{13,77,92} Technology-based interventions, such as text messaging, may have a role in supporting ART adherence and decreasing methamphetamine use among persons with HIV, but further research is needed.⁹³ Persons with HIV who use stimulants benefit most from multidimensional interventions that target substance use, ART adherence, and risky sexual behaviors.¹²

Despite the challenges discussed above, persons with HIV who use stimulants can achieve viral suppression with ART⁹⁴ and should be prescribed ART even if stimulant use is ongoing.

Tobacco

Epidemiology

The prevalence of tobacco smoking among persons with HIV in the United States is approximately twice that of the general population (33.6% vs. 16.8%). Prevalence is even higher among specific subgroups, including those who use alcohol and/or other drugs, those who have concurrent mental health disorders, and those of a lower socioeconomic status. While smoking rates are declining overall in the United States, persons with HIV are less likely to quit smoking than people in the general population.⁹⁵

Associated Risks of Tobacco Use and HIV Infection

With respect to substance use and HIV, tobacco smoking is the biggest threat to health-related gains achieved through ART. Among individuals with viral suppression on ART, more years of life may be lost from continued smoking than from HIV infection itself.^{96,97} Tobacco smoking among persons with HIV is associated with an increased risk of numerous health conditions, including lung cancer and other smoking-related cancers, cardiovascular disease, and pulmonary disease. In a sample of 17,995 persons with HIV on ART in Europe and North America, individuals who smoked had nearly twice the mortality of those who did not (mortality rate ratio 1.94; 95% CI, 1.56–2.41) with significant mortality attributed to cardiovascular disease and non-AIDS related malignancy.⁹⁶ Importantly, tobacco cessation reduces the incidence of cardiovascular disease and smoking-related cancers (though definitive data on lung cancer are not available) and improves quality of life.⁹⁸⁻¹⁰⁰

Managing Tobacco Use

To maximize the survival benefits of ART, clinicians should consider using evidence-based behavioral and pharmacological¹⁰¹⁻¹⁰³ cessation strategies when treating patients with HIV who smoke tobacco (see the tools and recommendations provided by the [CDC](#) and the [U.S. Preventive Services Task Force](#)). These include (but are not limited to) advising the patient to quit smoking, using [the five A's](#), employing motivational interviewing, and referring the patient to a tobacco quitline. Pharmacotherapies for smoking cessation (nicotine replacement therapy, bupropion, and varenicline) have few clinically significant interactions with ARV drugs and can lead to enormous reductions in morbidity and mortality if the person is able to stop smoking. Nicotine replacement is efficacious;¹⁰⁴ however, bupropion doubles rates of smoking cessation compared with nicotine replacement therapy.¹⁰⁵ Varenicline is a partial nicotine receptor agonist. In comparative studies, varenicline was more effective than bupropion in smoking cessation.^{105,106} Clinical trials among persons with HIV have found varenicline to be both effective and safe.^{101,103} In a recent randomized controlled trial among 179 individuals with HIV who were randomized to receive 12 weeks of behavioral counseling and either varenicline or placebo, varenicline use led to an increase in the percentage of participants who achieved a 7-day abstinence period at 12 weeks (28.1% vs. 12.1%, OR 4.5; 95% CI, 1.83–11.2) and produced higher continuous abstinence between weeks 9 and 12 (23.6% vs. 10%, OR 4.65; 95% CI, 1.71–12.67) compared to placebo.¹⁰³ While significant between-group differences were not observed after 24 weeks, these data support the use of varenicline among persons with HIV. Varenicline should be used

in combination with relapse prevention strategies and other measures for long-term tobacco cessation.

Table 13. Medications for Treatment of Substance Use Disorders

Medication	Dose and Recommendations	Potential Interaction with ARV Drugs	Comments
Alcohol Use Disorder			
Acamprosate	666 mg PO three times a day <i>or</i> 333 mg PO three times a day for patients with CrCl 30–50 mL/min	No significant interaction with ARV drugs expected.	Contraindicated in patients with CrCl <30 mL/min.
Disulfiram	250 mg PO once daily	Use with caution when prescribing an ARV oral solution that contains ethanol and/or propylene glycol (e.g., FPV, LPV/r, RTV).	Counsel patients regarding disulfiram reaction when taken with alcohol; symptoms for the reaction may include flushing, tachycardia, nausea, vomiting, or hypotension.
Naltrexone	50–100 mg PO once daily Depot formulation is a fixed-dose monthly injection.	No significant interaction with ARV drugs expected.	Has the greatest efficacy of all FDA-approved medications for alcohol use disorder.
Opioid Use Disorder			
Buprenorphine	Individualize buprenorphine dosing based on a patient's opioid use. The dose range is 4–24 mg sublingually. Dosing is once daily or twice daily.	Potential interaction with ARV drugs that are CYP inhibitors or inducers. See Drug-Drug Interactions for further recommendations.	Buprenorphine has 90% first pass hepatic metabolism. Verify that the patient is using the appropriate technique for sublingual administration before adjusting the dose, as improper administration will result in poor absorption and low drug levels.
Methadone	Individualize dose. Patients who receive higher doses (>100 mg) are more likely to remain in treatment.	Potential interaction with ARV drugs that are CYP inhibitors or inducers. See Drug-Drug Interactions for further recommendations.	QTc prolongation is a concern at higher doses. Methadone can only be prescribed for OUD by a licensed OTP.
Naltrexone	50–100 mg PO once daily Depot formulation is a fixed-dose monthly injection.	No significant interaction with ARV drugs expected.	Longer time of continuous abstinence in those who received depot formulation naltrexone compared to placebo after transition from prison to community.
Nicotine Use Disorder			
Nicotine Replacement Therapy	There are a wide variety of FDA-approved nicotine replacement products. All formulations are effective.	No significant interaction with ARV drugs expected.	Work with the patient to identify the route of delivery that the patient will use and find most helpful.
Bupropion	Start at 150 mg PO daily for three days, then increase to either 150 mg twice daily or 300 mg once daily (only use formulations that are approved for once daily dosing).	Concentration may be reduced when used with ARV drugs that are CYP2D6 inducers. See Drug-Drug Interactions for further recommendations.	Tobacco quit date should ideally be 1 week after starting therapy.
Varenicline	Titrate dose based on tolerability until desired effect is achieved. The goal is to reach a dose of 1 mg PO twice daily. Requires dose adjustment in patients with CrCl <30 mL/min.	No significant interaction with ARV drugs expected.	Tobacco quit date should ideally be 1 week after starting therapy.

Key: ARV = antiretroviral; CrCl = creatinine clearance; CYP = cytochrome P; FDA = Food and Drug Administration; FPV = fosamprenavir; LPV/r = lopinavir/ritonavir; OUD = opioid use disorder; OTP = opioid treatment program; PO = orally; RTV = ritonavir; SR = sustained release

References

1. HIV.gov. U.S. Statistics. 2019. Available at: <https://www.hiv.gov/hiv-basics/overview/data-and-trends/statistics>.
2. Centers for Disease Control and Prevention. Drug Overdose Deaths. 2018; <https://www.cdc.gov/drugoverdose/data/statedeaths.html>.
3. Bowman S, Eiserman J, Beletsky L, Stancliff S, Bruce RD. Reducing the health consequences of opioid addiction in primary care. *Am J Med*. 2013;126(7):565-571. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/23664112>.
4. Shiao S, Arpadi SM, Yin MT, Martins SS. Patterns of drug use and HIV infection among adults in a nationally representative sample. *Addict Behav*. 2017;68:39-44. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/28088742>.
5. National Institute on Drug Abuse. Club Drugs. <https://www.drugabuse.gov/drugs-abuse/club-drugs>. Accessed May 30, 2019.
6. Pakianathan M, Whittaker W, Lee MJ, et al. Chemsex and new HIV diagnosis in gay, bisexual and other men who have sex with men attending sexual health clinics. *HIV Med*. 2018. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/29790254>.
7. Kohli M, Hickson F, Free C, Reid D, Weatherburn P. Cross-sectional analysis of chemsex drug use and gonorrhoea diagnosis among men who have sex with men in the UK. *Sex Health*. 2019. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/30760386>.
8. Smith PC, Schmidt SM, Allensworth-Davies D, Saitz R. A single-question screening test for drug use in primary care. *Arch Intern Med*. 2010;170(13):1155-1160. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/20625025>.
9. Altice FL, Mostashari F, Friedland GH. Trust and the acceptance of and adherence to antiretroviral therapy. *J Acquir Immune Defic Syndr*. 2001;28(1):47-58. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/11579277>.
10. Marinetti L, Montgomery MA. The Use of GHB to Facilitate Sexual Assault. *Forensic Sci Rev*. 2010;22(1):41-59. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/26242455>.
11. Basu S, Chwastiak LA, Bruce RD. Clinical management of depression and anxiety in HIV-infected adults. *AIDS*. 2005;19(18):2057-2067. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/16284454>.
12. Wechsberg WM, Golin C, El-Bassel N, Hopkins J, Zule W. Current interventions to reduce sexual risk behaviors and crack cocaine use among HIV-infected individuals. *Curr HIV/AIDS Rep*. 2012;9(4):385-393. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/22872433>.
13. Carrico AW, Gomicronmez W, Jain J, et al. Randomized controlled trial of a positive affect intervention for methamphetamine users. *Drug Alcohol Depend*. 2018;192:8-15. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/30195243>.
14. Griffith DC, Farmer C, Gebo KA, et al. Uptake and virological outcomes of single- versus multi-tablet antiretroviral regimens among treatment-naïve youth in the HIV Research Network. *HIV Med*. 2019;20(2):169-174. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/30561888>.
15. Feldman MB, Kepler KL, Irvine MK, Thomas JA. Associations between drug use patterns and viral load suppression among HIV-positive individuals who use support services in New York City. *Drug Alcohol Depend*. 2019;197:15-21. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/30743195>.
16. Williams EC, Joo YS, Lipira L, Glass JE. Psychosocial stressors and alcohol use, severity, and treatment receipt across human immunodeficiency virus (HIV) status in a nationally representative sample of US residents. *Subst Abus*. 2017;38(3):269-277. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/27925867>.
17. Crane HM, McCaul ME, Chander G, et al. Prevalence and Factors Associated with Hazardous Alcohol Use Among Persons Living with HIV Across the US in the Current Era of Antiretroviral Treatment. *AIDS Behav*. 2017;21(7):1914-1925. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/28285434>.
18. Saitz R. Clinical practice. Unhealthy alcohol use. *N Engl J Med*. 2005;352(6):596-607. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/15703424>.
19. Scott-Sheldon LA, Carey KB, Cunningham K, Johnson BT, Carey MP, Team MR. Alcohol Use Predicts Sexual

- Decision-Making: A Systematic Review and Meta-Analysis of the Experimental Literature. *AIDS Behav.* 2016;20 Suppl 1:S19-39. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/26080689>.
20. Shuper PA, Joharchi N, Monti PM, Loutfy M, Rehm J. Acute Alcohol Consumption Directly Increases HIV Transmission Risk: A Randomized Controlled Experiment. *J Acquir Immune Defic Syndr.* 2017;76(5):493-500. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/28930769>.
 21. Rehm J, Shield KD, Joharchi N, Shuper PA. Alcohol consumption and the intention to engage in unprotected sex: systematic review and meta-analysis of experimental studies. *Addiction.* 2012;107(1):51-59. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/22151318>.
 22. Williams EC, McGinnis KA, Edelman EJ, et al. Level of Alcohol Use Associated with HIV Care Continuum Targets in a National U.S. Sample of Persons Living with HIV Receiving Healthcare. *AIDS Behav.* 2019;23(1):140-151. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/29995206>.
 23. Vagenas P, Azar MM, Copenhaver MM, Springer SA, Molina PE, Altice FL. The Impact of Alcohol Use and Related Disorders on the HIV Continuum of Care: a Systematic Review : Alcohol and the HIV Continuum of Care. *Curr HIV/AIDS Rep.* 2015;12(4):421-436. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/26412084>.
 24. Braithwaite RS, McGinnis KA, Conigliaro J, et al. A temporal and dose-response association between alcohol consumption and medication adherence among veterans in care. *Alcohol Clin Exp Res.* 2005;29(7):1190-1197. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/16046874>.
 25. Braithwaite RS, Bryant KJ. Influence of alcohol consumption on adherence to and toxicity of antiretroviral therapy and survival. *Alcohol Res Health.* 2010;33(3):280-287. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/23584069>.
 26. Parsons JT, Rosof E, Mustanski B. Patient-related factors predicting HIV medication adherence among men and women with alcohol problems. *J Health Psychol.* 2007;12(2):357-370. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/17284499>.
 27. Kalichman SC, Grebler T, Amaral CM, et al. Viral suppression and antiretroviral medication adherence among alcohol using HIV-positive adults. *Int J Behav Med.* 2014;21(5):811-820. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/24085706>.
 28. Pellowski JA, Kalichman SC, Kalichman MO, Cherry C. Alcohol-antiretroviral therapy interactive toxicity beliefs and daily medication adherence and alcohol use among people living with HIV. *AIDS Care.* 2016;28(8):963-970. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/26964014>.
 29. Williams EC, Hahn JA, Saitz R, Bryant K, Lira MC, Samet JH. Alcohol Use and Human Immunodeficiency Virus (HIV) Infection: Current Knowledge, Implications, and Future Directions. *Alcohol Clin Exp Res.* 2016;40(10):2056-2072. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/27696523>.
 30. Cook RL, Sereika SM, Hunt SC, Woodward WC, Erlen JA, Conigliaro J. Problem drinking and medication adherence among persons with HIV infection. *J Gen Intern Med.* 2001;16(2):83-88. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/11251758>.
 31. Kelso NE, Sheps DS, Cook RL. The association between alcohol use and cardiovascular disease among people living with HIV: a systematic review. *Am J Drug Alcohol Abuse.* 2015;41(6):479-488. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/26286352>.
 32. Lesko CR, Lau B, Chander G, Moore RD. Time Spent with HIV Viral Load > 1500 Copies/mL Among Persons Engaged in Continuity HIV Care in an Urban Clinic in the United States, 2010-2015. *AIDS Behav.* 2018;22(11):3443-3450. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/29541913>.
 33. Monroe AK, Lau B, Mugavero MJ, et al. Heavy Alcohol Use Is Associated With Worse Retention in HIV Care. *J Acquir Immune Defic Syndr.* 2016;73(4):419-425. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/27243904>.
 34. Ladak F, Socias E, Nolan S, et al. Substance use patterns and HIV-1 RNA viral load rebound among HIV-positive illicit drug users in a Canadian setting. *Antivir Ther.* 2019;24(1):19-25. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/30230474>.
 35. DeLorenze GN, Weisner C, Tsai AL, Satre DD, Quesenberry CP, Jr. Excess mortality among HIV-infected patients diagnosed with substance use dependence or abuse receiving care in a fully integrated medical care program. *Alcohol*

Clin Exp Res. 2011;35(2):203-210. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/21058961>.

36. Canan CE, Lau B, McCaul ME, Keruly J, Moore RD, Chander G. Effect of alcohol consumption on all-cause and liver-related mortality among HIV-infected individuals. *HIV Med.* 2017;18(5):332-341. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/27679418>.
37. Eyawo O, McGinnis KA, Justice AC, et al. Alcohol and Mortality: Combining Self-Reported (AUDIT-C) and Biomarker Detected (PEth) Alcohol Measures Among HIV Infected and Uninfected. *J Acquir Immune Defic Syndr.* 2018;77(2):135-143. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/29112041>.
38. Marcellin F, Roux P, Loko MA, et al. High levels of alcohol consumption increase the risk of advanced hepatic fibrosis in HIV/hepatitis C virus-coinfected patients: a sex-based analysis using transient elastography at enrollment in the HEPAVIH ANRS CO13 cohort. *Clin Infect Dis.* 2014;59(8):1190-1192. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/25015913>.
39. Lim JK, Tate JP, Fultz SL, et al. Relationship between alcohol use categories and noninvasive markers of advanced hepatic fibrosis in HIV-infected, chronic hepatitis C virus-infected, and uninfected patients. *Clin Infect Dis.* 2014;58(10):1449-1458. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/24569533>.
40. Scott-Sheldon LAJ, Carey KB, Johnson BT, Carey MP, Team MR. Behavioral Interventions Targeting Alcohol Use Among People Living with HIV/AIDS: A Systematic Review and Meta-Analysis. *AIDS Behav.* 2017;21(Suppl 2):126-143. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/28831609>.
41. Edelman EJ, Moore BA, Holt SR, et al. Efficacy of Extended-Release Naltrexone on HIV-Related and Drinking Outcomes Among HIV-Positive Patients: A Randomized-Controlled Trial. *AIDS Behav.* 2019;23(1):211-221. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/30073637>.
42. Springer SA, Di Paola A, Azar MM, et al. Extended-Release Naltrexone Improves Viral Suppression Among Incarcerated Persons Living With HIV With Opioid Use Disorders Transitioning to the Community: Results of a Double-Blind, Placebo-Controlled Randomized Trial. *J Acquir Immune Defic Syndr.* 2018;78(1):43-53. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/29373393>.
43. Edelman EJ, Maisto SA, Hansen NB, et al. Integrated stepped alcohol treatment for patients with HIV and alcohol use disorder: a randomised controlled trial. *Lancet HIV.* 2019. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/31109915>.
44. Barker MJ, Greenwood KM, Jackson M, Crowe SF. Cognitive effects of long-term benzodiazepine use: a meta-analysis. *CNS Drugs.* 2004;18(1):37-48. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/14731058>.
45. Darke S, Hall W, Ross M, Wodak A. Benzodiazepine use and HIV risk-taking behaviour among injecting drug users. *Drug Alcohol Depend.* 1992;31(1):31-36. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/1358587>.
46. Walton GR, Hayashi K, Bach P, et al. The Impact of Benzodiazepine Use on Mortality Among Polysubstance Users in Vancouver, Canada. *Public Health Rep.* 2016;131(3):491-499. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/27252569>.
47. Newville H, Roley J, Sorensen JL. Prescription medication misuse among HIV-infected individuals taking antiretroviral therapy. *J Subst Abuse Treat.* 2015;48(1):56-61. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/25245428>.
48. Motta-Ochoa R, Bertrand K, Arruda N, Jutras-Aswad D, Roy E. "I love having benzos after my coke shot": The use of psychotropic medication among cocaine users in downtown Montreal. *Int J Drug Policy.* 2017;49:15-23. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/28826127>.
49. Bruce RD, Altice FL, Friedland GH. Pharmacokinetic drug interactions between drugs of abuse and antiretroviral medications: implications and management for clinical practice. *Expert Rev Clin Pharmacol.* 2008;1(1):115-127. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/24410515>.
50. Pacek LR, Towe SL, Hobkirk AL, Nash D, Goodwin RD. Frequency of Cannabis Use and Medical Cannabis Use Among Persons Living With HIV in the United States: Findings From a Nationally Representative Sample. *AIDS Educ Prev.* 2018;30(2):169-181. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/29688777>.
51. Drug Enforcement Administration Diversion Control Division. *Special Report: Synthetic Cannabinoids and Synthetic Cathinones Reported in NFLIS, 2013-2015.* 2016. Available at: <https://www.nflis.deadiversion.usdoj.gov/DesktopModules/ReportDownloads/Reports/NFLIS-SR-SynthCannabinoidCathinone.pdf>. Accessed: May 30, 2019.

52. Tait RJ, Caldicott D, Mountain D, Hill SL, Lenton S. A systematic review of adverse events arising from the use of synthetic cannabinoids and their associated treatment. *Clin Toxicol (Phila)*. 2016;54(1):1-13. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/26567470>.
53. Lake S, Kerr T, Capler R, Shoveller J, Montaner J, Milloy MJ. High-intensity cannabis use and HIV clinical outcomes among HIV-positive people who use illicit drugs in Vancouver, Canada. *Int J Drug Policy*. 2017;42:63-70. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/28336000>.
54. Lorenz DR, Dutta A, Mukerji SS, Holman A, Uno H, Gabuzda D. Marijuana Use Impacts Midlife Cardiovascular Events in HIV-Infected Men. *Clin Infect Dis*. 2017;65(4):626-635. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/28449059>.
55. Clayton HB, Lowry R, Ashley C, Wolkin A, Grant AM. Health Risk Behaviors With Synthetic Cannabinoids Versus Marijuana. *Pediatrics*. 2017;139(4). Available at: <https://www.ncbi.nlm.nih.gov/pubmed/28289138>.
56. Sinha S, McCaul ME, Hutton HE, et al. Marijuana use and HIV treatment outcomes among PWH receiving care at an urban HIV clinic. *J Subst Abuse Treat*. 2017;82:102-106. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/29021107>.
57. Gates PJ, Sabioni P, Copeland J, Le Foll B, Gowing L. Psychosocial interventions for cannabis use disorder. *Cochrane Database Syst Rev*. 2016(5):CD005336. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/27149547>.
58. Stephens RS, Roffman RA, Curtin L. Comparison of extended versus brief treatments for marijuana use. *J Consult Clin Psychol*. 2000;68(5):898-908. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/11068976>.
59. Copeland J, Swift W, Roffman R, Stephens R. A randomized controlled trial of brief cognitive-behavioral interventions for cannabis use disorder. *J Subst Abuse Treat*. 2001;21(2):55-64; discussion 65-56. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/11551733>.
60. Daskalopoulou M, Rodger A, Phillips AN, et al. Recreational drug use, polydrug use, and sexual behaviour in HIV-diagnosed men who have sex with men in the UK: results from the cross-sectional ASTRA study. *Lancet HIV*. 2014;1(1):e22-31. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/26423813>.
61. Inciardi JA, Surratt HL, Kurtz SP, Cicero TJ. Mechanisms of prescription drug diversion among drug-involved club- and street-based populations. *Pain Med*. 2007;8(2):171-183. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/17305688>.
62. Bracchi M, Stuart D, Castles R, Khoo S, Back D, Boffito M. Increasing use of ‘party drugs’ in people living with HIV on antiretrovirals: a concern for patient safety. *AIDS*. 2015;29(13):1585-1592. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/26372268>.
63. Colfax G, Guzman R. Club drugs and HIV infection: a review. *Clin Infect Dis*. 2006;42(10):1463-1469. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/16619161>.
64. Peters PJ, Pontones P, Hoover KW, et al. HIV Infection Linked to Injection Use of Oxymorphone in Indiana, 2014-2015. *N Engl J Med*. 2016;375(3):229-239. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/27468059>.
65. Scholl L, Seth P, Kariisa M, Wilson N, Baldwin G. Drug and Opioid-Involved Overdose Deaths - United States, 2013-2017. *MMWR Morb Mortal Wkly Rep*. 2018;67(5152):1419-1427. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/30605448>.
66. Bruce RD, Merlin J, Lum PJ, et al. 2017 HIV Medicine Association of Infectious Diseases Society of America Clinical Practice Guideline for the Management of Chronic Pain in Patients Living With Human Immunodeficiency Virus. *Clin Infect Dis*. 2017;65(10):1601-1606. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/29091230>.
67. Khatri UG, Viner K, Perrone J. Lethal Fentanyl and Cocaine Intoxication. *N Engl J Med*. 2018;379(18):1782. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/30380395>.
68. LaRue L, Twillman RK, Dawson E, et al. Rate of Fentanyl Positivity Among Urine Drug Test Results Positive for Cocaine or Methamphetamine. *JAMA Netw Open*. 2019;2(4):e192851. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/31026029>.
69. Hoots BE, Finlayson TJ, Broz D, Paz-Bailey G, Group NS. Antiretroviral Therapy Use Among HIV-Infected People Who Inject Drugs—20 Cities, United States, 2009-2015. *J Acquir Immune Defic Syndr*. 2017;75 Suppl 3:S392-S396. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/28604444>.

70. Lesko CR, Tong W, Moore RD, Lau B. Retention, Antiretroviral Therapy Use and Viral Suppression by History of Injection Drug Use Among HIV-Infected Patients in an Urban HIV Clinical Cohort. *AIDS Behav.* 2017;21(4):1016-1024. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/27752872>.
71. Altice FL, Bruce RD, Lucas GM, et al. HIV treatment outcomes among HIV-infected, opioid-dependent patients receiving buprenorphine/naloxone treatment within HIV clinical care settings: results from a multisite study. *J Acquir Immune Defic Syndr.* 2011;56 Suppl 1:S22-32. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/21317590>.
72. Kresina TF, Bruce RD, McCance-Katz EF. Medication assisted treatment in the treatment of drug abuse and dependence in HIV/AIDS infected drug users. *Curr HIV Res.* 2009;7(4):354-364. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/19601770>.
73. Woody GE, Bruce D, Korthuis PT, et al. HIV risk reduction with buprenorphine-naloxone or methadone: findings from a randomized trial. *J Acquir Immune Defic Syndr.* 2014;66(3):288-293. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/24751432>.
74. Schottenfeld RS, Chawarski MC, Mazlan M. Maintenance treatment with buprenorphine and naltrexone for heroin dependence in Malaysia: a randomised, double-blind, placebo-controlled trial. *Lancet.* 2008;371(9631):2192-2200. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/18586174>.
75. Kirchmayer U, Davoli M, Verster AD, Amato L, Ferri A, Perucci CA. A systematic review on the efficacy of naltrexone maintenance treatment in opioid dependence. *Addiction.* 2002;97(10):1241-1249. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/12359026>.
76. Hartzler B, Dombrowski JC, Crane HM, et al. Prevalence and Predictors of Substance Use Disorders Among HIV Care Enrollees in the United States. *AIDS Behav.* 2017;21(4):1138-1148. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/27738780>.
77. Mimiaga MJ, Reisner SL, Grasso C, et al. Substance use among HIV-infected patients engaged in primary care in the United States: findings from the Centers for AIDS Research Network of Integrated Clinical Systems cohort. *Am J Public Health.* 2013;103(8):1457-1467. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/23763417>.
78. Rosen MI, Black AC, Arnsten JH, et al. Association between use of specific drugs and antiretroviral adherence: findings from MACH 14. *AIDS Behav.* 2013;17(1):142-147. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/22246513>.
79. Vu NT, Maher L, Zablotska I. Amphetamine-type stimulants and HIV infection among men who have sex with men: implications on HIV research and prevention from a systematic review and meta-analysis. *J Int AIDS Soc.* 2015;18:19273. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/25609214>.
80. Chitsaz E, Meyer JP, Krishnan A, et al. Contribution of substance use disorders on HIV treatment outcomes and antiretroviral medication adherence among HIV-infected persons entering jail. *AIDS Behav.* 2013;17 Suppl 2:S118-127. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/23673792>.
81. Mediouni S, Marcondes MC, Miller C, McLaughlin JP, Valente ST. The cross-talk of HIV-1 Tat and methamphetamine in HIV-associated neurocognitive disorders. *Front Microbiol.* 2015;6:1164. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/26557111>.
82. Tyagi M, Weber J, Bukrinsky M, Simon GL. The effects of cocaine on HIV transcription. *J Neurovirol.* 2016;22(3):261-274. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/26572787>.
83. Dash S, Balasubramaniam M, Villalta F, Dash C, Pandhare J. Impact of cocaine abuse on HIV pathogenesis. *Front Microbiol.* 2015;6:1111. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/26539167>.
84. Carrico AW, Flentje A, Kober K, et al. Recent stimulant use and leukocyte gene expression in methamphetamine users with treated HIV infection. *Brain Behav Immun.* 2018;71:108-115. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/29679637>.
85. Carrico AW, Cherenack EM, Roach ME, et al. Substance-associated elevations in monocyte activation among methamphetamine users with treated HIV infection. *AIDS.* 2018;32(6):767-771. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/29369159>.
86. Jin H, Ogunbajo A, Mimiaga MJ, et al. Over the influence: The HIV care continuum among methamphetamine-using men who have sex with men. *Drug Alcohol Depend.* 2018;192:125-128. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/29369159>.

pubmed/30248558.

87. Minozzi S, Cinquini M, Amato L, et al. Anticonvulsants for cocaine dependence. *Cochrane Database Syst Rev*. 2015(4):CD006754. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/25882271>.
88. Minozzi S, Amato L, Pani PP, et al. Dopamine agonists for the treatment of cocaine dependence. *Cochrane Database Syst Rev*. 2015(5):CD003352. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/26014366>.
89. Hayashi K, Wood E, Kerr T, et al. Factors associated with optimal pharmacy refill adherence for antiretroviral medications and plasma HIV RNA non-detectability among HIV-positive crack cocaine users: a prospective cohort study. *BMC Infect Dis*. 2016;16(1):455. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/27568002>.
90. Berg KM, Litwin A, Li X, Heo M, Arnsten JH. Directly observed antiretroviral therapy improves adherence and viral load in drug users attending methadone maintenance clinics: a randomized controlled trial. *Drug Alcohol Depend*. 2011;113(2-3):192-199. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/20832196>.
91. Bruce R. Addiction In: Gendelman E, Grant I, Everall I, et al., eds. *The Neurology of AIDS*. 3rd ed.: Oxford University Press; 2011.
92. Burch AE, Rash CJ, Petry NM. Cocaine-using substance abuse treatment patients with and without HIV respond well to contingency management treatment. *J Subst Abuse Treat*. 2017;77:21-25. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/28476266>.
93. Moore DJ, Pasipanodya EC, Umlauf A, et al. Individualized texting for adherence building (iTAB) for methamphetamine users living with HIV: A pilot randomized clinical trial. *Drug Alcohol Depend*. 2018;189:154-160. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/29958127>.
94. Carrico AW, Hunt PW, Neilands TB, et al. Stimulant Use and Viral Suppression in the Era of Universal Antiretroviral Therapy. *J Acquir Immune Defic Syndr*. 2019;80(1):89-93. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/30272634>.
95. Frazier EL, Sutton MY, Brooks JT, Shouse RL, Weiser J. Trends in cigarette smoking among adults with HIV compared with the general adult population, United States - 2009-2014. *Prev Med*. 2018;111:231-234. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/29550303>.
96. Helleberg M, May MT, Ingle SM, et al. Smoking and life expectancy among HIV-infected individuals on antiretroviral therapy in Europe and North America. *AIDS*. 2015;29(2):221-229. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/25426809>.
97. Reddy KP, Parker RA, Losina E, et al. Impact of Cigarette Smoking and Smoking Cessation on Life Expectancy Among People With HIV: A US-Based Modeling Study. *J Infect Dis*. 2016;214(11):1672-1681. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/27815384>.
98. Petoumenos K, Worm S, Reiss P, et al. Rates of cardiovascular disease following smoking cessation in patients with HIV infection: results from the D:A:D study(*). *HIV Med*. 2011;12(7):412-421. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/21251183>.
99. Vidrine DJ, Arduino RC, Gritz ER. The effects of smoking abstinence on symptom burden and quality of life among persons living with HIV/AIDS. *AIDS Patient Care STDS*. 2007;21(9):659-666. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/17919093>.
100. Shepherd L, Ryom L, Law M, et al. Cessation of Cigarette Smoking and the Impact on Cancer Incidence in Human Immunodeficiency Virus-infected Persons: The Data Collection on Adverse Events of Anti-HIV Drugs Study. *Clin Infect Dis*. 2019;68(4):650-657. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/29912335>.
101. Mercie P, Arsandaux J, Katlama C, et al. Efficacy and safety of varenicline for smoking cessation in people living with HIV in France (ANRS 144 Inter-ACTIV): a randomised controlled phase 3 clinical trial. *Lancet HIV*. 2018;5(3):e126-e135. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/29329763>.
102. Anthenelli RM, Benowitz NL, West R, et al. Neuropsychiatric safety and efficacy of varenicline, bupropion, and nicotine patch in smokers with and without psychiatric disorders (EAGLES): a double-blind, randomised, placebo-controlled clinical trial. *Lancet*. 2016;387(10037):2507-2520. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/27116918>.
103. Ashare RL, Thompson M, Serrano K, et al. Placebo-controlled randomized clinical trial testing the efficacy and safety of

varenicline for smokers with HIV. *Drug Alcohol Depend.* 2019;200:26-33. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/31082665>.

104. Amodei N, Lamb RJ. The role of nicotine replacement therapy in early quitting success. *Nicotine Tob Res.* 2010;12(1):1-10. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/19897526>.
105. Gonzales D, Rennard SI, Nides M, et al. Varenicline, an alpha4beta2 nicotinic acetylcholine receptor partial agonist, vs sustained-release bupropion and placebo for smoking cessation: a randomized controlled trial. *JAMA.* 2006;296(1):47-55. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/16820546>.
106. West R, Baker CL, Cappelleri JC, Bushmakin AG. Effect of varenicline and bupropion SR on craving, nicotine withdrawal symptoms, and rewarding effects of smoking during a quit attempt. *Psychopharmacology (Berl).* 2008;197(3):371-377. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/18084743>.