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FREQUENCY OF CANNABIS USE AND MEDICAL CANNABIS USE AMONG PERSONS LIVING WITH HIV IN THE UNITED STATES: FINDINGS FROM A NATIONALLY REPRESENTATIVE SAMPLE

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Abstract

Little is known about cannabis use frequency, medical cannabis use, or correlates of use among persons living with HIV (PLWH) in United States nationally representative samples. Data came from 626 PLWH from the 2005–2015 National Survey on Drug Use and Health. Logistic regression identified characteristics associated with frequency of cannabis use. Chi-squares identified characteristics associated with medical cannabis use. Non-daily and daily cannabis use was reported by 26.9% and 8.0%. Greater perceived risk of cannabis use was negatively associated with daily and non-daily use. Younger age, substance use, and binge drinking were positively associated with non-daily cannabis use. Smoking and depression were associated with non-daily and daily use. One-quarter reported medical cannabis use. Medical users were more likely to be White, married, and nondrinkers. Cannabis use was common among PLWH. Findings help to differentiate between cannabis users based on frequency of use and medical versus recreational use.

Cannabis use is more prevalent among persons living with HIV (PLWH) than among the United States (U.S.) general population (23%–56% versus 13.3%) (Allshouse et al., 2015; Compton, Han, Jones, Blanco, & Hughes, 2016; Harris et al., 2014; Hosek, Harper, & Domanico, 2005; Prentiss, Power, Balmas, Tzuang, & Israelski, 2004; Slawson et al., 2015). The prevalence of cannabis use for medicinal purposes is also common in this group: 22%–67% of PLWH who are current cannabis users also report current medical use (D’Souza et al., 2012; Furler, Einarson, Millson, Walmsley, & Bendayan, 2004; Harris et al., 2014). Some research indicates that cannabis use may reduce HIV-related symptoms (Abrams et al., 2007; Ellis et al., 2009; Furler et al., 2004; Haney et al., 2007; Prentiss et al.,

2004; Seamon, Fass, Maniscalco-Feichtl, & Abu-Shraie, 2007) and help to alleviate anxiety and depression (Haney et al., 2007; Prentiss et al., 2004). However, the evidence for positive effects of cannabis in PLWH is limited; a systematic review indicates that the randomized controlled trials that have been conducted include small sample sizes and have focused on short-term effects (Lutge, Gray, & Siegfried, 2013).

In the general population, heavy cannabis use is associated with a host of social, psychological, and physical impairments, including financial difficulties, low energy levels, dissatisfaction with productivity levels, sleep and memory issues, and relationship and family problems (Gruber, Pope, Hudson, & Yurgelun-Todd, 2003; Stephens, Babor, Kadden, Miller, & Marijuana Treatment Project Research Group, 2002). Long-term use is associated with increased risk of cannabis dependence (Lopez-Quintero et al., 2011), with treatment-seeking individuals reporting difficulty quitting, and experiencing a withdrawal syndrome after cessation (Budney, Roffman, Stephens, & Walker, 2007; Vandrey, Budney, Hughes, & Liguori, 2008; Volkow, Compton, & Weiss, 2014). Despite the aforementioned medical benefits, among PLWH, cannabis use has also been associated with poor adherence to antiretroviral therapy (ART; Bonn-Miller, Oser, Bucossi, & Trafton, 2014; Wilson, Doxanakis, & Fairley, 2004), decreased cognitive functioning (Cristiani, Pukay-Martin, & Bornstein, 2004), lower mental quality of life, lower social engagement, and un- or underemployment (Allshouse et al., 2015).

Prior research has identified a number of correlates of self-reported cannabis use in PLWH. Recent alcohol use (Prentiss et al., 2004), current tobacco use, as well as current (D'Souza et al., 2012; Harris et al., 2014) and former illicit substance use (Furler et al., 2004) has been associated with current cannabis use. Medical comorbidities—including clinical indications for medical marijuana—like peripheral neuropathy, asthma, depression, and nausea are also associated with current (D'Souza et al., 2012; Prentiss et al., 2004) and weekly (Kuo et al., 2004) cannabis use. In a study conducted among women only, D'Souza and colleagues (2012) found that individuals reporting any current cannabis use were less likely to be on ART, and among those on ART, were less likely to be optimally adherent to their medication regimen. Individuals reporting daily cannabis use were more likely to have higher CD4 cell counts (D'Souza et al., 2012), and Kuo and colleagues (Kuo et al., 2004) also found, in a sample of HIV-positive females, that weekly cannabis users were less likely to be on highly active antiretroviral therapy (HAART) and, were less likely to have undetectable viral loads. However, much of the existing research has focused on identifying correlates of any cannabis use during a given time frame; less work has focused on differentiating correlates of cannabis use based on frequency of use (e.g., daily versus non-daily). Given the association between heavier cannabis use and adverse outcomes, identifying correlates of heavier versus lighter use may be of utility. Moreover, even less is known about correlates of medical cannabis use, with few exceptions: Furler and colleagues (Furler et al., 2004) identified lower income, prior substance use, and poorer health as correlates.

To date, the majority of the research concerning cannabis use in PLWH has focused on clinical samples of individuals currently in HIV care (Bing et al., 2001; Mimiaga et al., 2013). To our knowledge, there has been no examination of cannabis use among PLWH in a nationally representative sample. As approximately 45% of PLWH in the U.S. are not

retained in HIV medical care (Centers for Disease Control and Prevention, 2016), investigation of cannabis use exclusively in clinical samples does not provide an estimate that is generalizable to the population. Having community-based and nationally representative prevalence estimates for this population is critical given the previously reported higher prevalence of cannabis use in this population, as well as evolving regulations governing medical cannabis within the U.S. that have the potential to influence individuals' decisions and ability to use cannabis. Against this background, the present study had several aims. First, we aimed to estimate the prevalence and frequency—daily and non-daily—of cannabis use. Next, we aimed to estimate the prevalence of medical cannabis use. Last, we aimed to identify correlates of cannabis use—daily, non-daily, and medical use—among PLWH in the U.S.

METHODS

DATA SOURCE

Data were obtained from the 2005–2015 National Survey on Drug Use and Health (NSDUH) public use data files, a combined initial sample size of 617,245 U.S. individuals. Of these, 626 (0.2%) self-reported having been previously diagnosed with HIV and were age 18 or older and comprised the present sample. The NSDUH, sponsored by the Substance Abuse and Mental Health Services Administration (SAMHSA), was designed to provide estimates of the prevalence of extra-medical use of legal and illegal drugs in U.S. community-based individuals aged 12 and older (Center for Behavioral Health Statistics and Quality, 2015). The survey employed a 50-state design with an independent multistage area probability sample for each of the 50 states and the District of Columbia. To increase the precision of estimates, African Americans, Hispanics, and young people were oversampled. Response rates for completed surveys ranged from 73–79%.

Informed consent was obtained before the start of every interview. Participants were given a description of the study, read a statement describing the legislation regarding the confidentiality of any information provided by participants, and assured that participation in the study was voluntary. Surveys were administered by computer-assisted personal interviewing (CAPI) conducted by an interviewer and audio computer-assisted self-interviewing (ACASI). Use of ACASI was designed to provide respondents with a private and confidential means of responding to questions, and to increase honest reporting of illegal drug use and other sensitive behaviors (Macalino, Celentano, Latkin, Strathdee, & Vlahov, 2002). Respondents were offered U.S. \$30 for participation. The analyses were based on de-identified publicly available data exempt from Institutional Review Board review.

Sampling weights for the NSDUH were computed to control for unit-level and individual-level nonresponse and were adjusted to ensure consistency with population estimates obtained from the U.S. Census Bureau. In order to use data from the 11 years of combined data, a new weight was created upon aggregating the 11 datasets by dividing the original sampling weight by the number of data sets combined. Further descriptions of the sampling methods, survey techniques, and weighting for the NSDUH are found elsewhere (Center for Behavioral Health Statistics and Quality, 2015).

MEASURES

Socio-demographic Variables.—Socio-demographic variables for this study included sex, race/ethnicity, age, marital status, total family income, educational attainment, and survey year. Age (18–25, 26–34, 35–49, 50+), race/ethnicity (White, Black, Hispanic, Other), and total family income (\$0–19,000, \$20,000–39,000, \$40,000–74,999, \$75,000+) were treated as categorical variables. Educational attainment (less than high school/GED; high school graduate/GED or greater) and marital status (married; not married) were dichotomized.

Cannabis Use Variables.—Participants who reported using cannabis or blunts: within the past 30 days, or more than 30 days ago but within the past 12 months, were categorized, separately, as past year users in new dichotomous variables. Participants indicating past year use reported the number of days they used cannabis in the last 12 months; those reporting using cannabis on 300 days or greater were classified as daily users (Budney, Moore, Vandrey, & Hughes, 2003; Budney et al., 2007; Pacek, Mauro, & Martins, 2015), while those reporting use on 299 days or less in the past year were classified as non-daily users. Information regarding cannabis use disorders (CUDs; i.e., abuse and/or dependence) was assessed with criteria from the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition, text revision (*DSM-IV-TR*; American Psychiatric Association, 2000).

Participants surveyed in 2013–2015 were categorized (yes/no) based on whether they resided in a state where a law allowing the use of cannabis for medical reasons was in effect on or before the interview date. Additionally, participants interviewed in these years who reported any past year cannabis use were also asked whether any of the cannabis use within the past 12 months was recommended by a doctor or other health care professional (yes/no).

Perceived Risk Associated With Cannabis Use.—Participants reported perceived risk associated with using cannabis on a regular basis (i.e., smoking cannabis once or twice a week): “How much do people risk harming themselves physically and in other ways when they smoke [cannabis] once or twice a week?” Response options included no risk, slight risk, moderate risk, and great risk. As in previous research (Compton et al., 2016; Pacek et al., 2015), perceived risk was dichotomized as great perceived risk versus other perceived risk.

Substance Use and Mental Health Variables.—Participants were asked about past year extra-medical use of substances other than cannabis, including painkillers, cocaine, hallucinogens, heroin, inhalants, sedatives, other stimulants, and tranquilizers. A dichotomous (yes/no) composite variable was created that described any past year drug use that summed across each of the individual past year drug use variables. A dichotomous (yes/no) variable for past year alcohol use and a dichotomous variable for past month binge drinking—defined as drinking at least five drinks on the same occasion on at least 1 day in the past 30 days—were created. Participants were considered current cigarette smokers if they reported: (1) smoking at least 100 cigarettes in their lifetime and (2) smoking at least 1 cigarette within the past 30 days. Lifetime major depressive episode (MDE) was defined as

experiencing 5 of 9 criteria, where at least one criterion is depressed mood or loss of interest or pleasure in daily activities.

STATISTICAL ANALYSES

Data were weighted to reflect the complex design of the NSDUH and were analyzed with STATA SE version 12.0 software (StataCorp, 2011). We used Taylor series estimation methods (i.e., STATA “svy” commands) to obtain proper standard error estimates. First, descriptive statistics were used to explore participants’ cannabis use characteristics. Next, participants were stratified by past-year cannabis use—no use versus non-daily use and daily use. Chi-square (χ^2) tests determined differences between groups. Multinomial logistic regression analyses were used to identify characteristics associated with past-year non-daily and daily cannabis use. Variables in the adjusted model were selected based on a combination of statistical significance ($p < .05$) in χ^2 analyses, the literature, and a priori theory, and included: sex, age, educational attainment, past-year substance use, cigarette smoking, binge drinking, lifetime MDE, perceived great risk of regular cannabis use, and survey year. Last, participants in survey years 2013–2015 were stratified by past-year medical cannabis use; Chi-square (χ^2) tests determined differences between groups. A small sample of PLWH in years 2013–2015 ($n = 95$) and small number of medical cannabis users ($n = 15$) precluded multivariate analysis of correlates of medical cannabis.

RESULTS

CANNABIS USE CHARACTERISTICS

Of the 626 PLWH in the present sample, 34.9% ($n = 245$) were past-year users of cannabis regardless of frequency, while 26.9% were non-daily users and 8.0% used cannabis daily (Table 1). Of the total sample, 5.6% met criteria for past year *DSM-IV* CUD. Among past-year users, 22.9% were daily cannabis users; on average, cannabis use was reported on 135.9 days ($SD = 107.8$) out of the past year. Approximately one-third (32.6%) of the cannabis users reported past-year blunt use. Sixteen percent of cannabis users met criteria for CUD. Additionally, of the 95 HIV-positive cannabis users surveyed in 2013–2015, 58.1% resided in a state with some provisions for medical cannabis and 26.0% reported any past-year medical cannabis use.

Non-daily and Daily Cannabis Use.—Daily cannabis users were less likely than non-daily or non-cannabis users to have a high school education/GED or greater (Wald $\chi^2 = 4.40$, $p = .019$; Table 2). Past-year substance use (Wald $\chi^2 = 10.07$, $p < .001$), cigarette smoking (Wald $\chi^2 = 10.54$, $p < .001$), alcohol use (Wald $\chi^2 = 8.47$, $p < .001$), binge drinking (Wald $\chi^2 = 7.58$, $p < .001$), and lifetime MDE (Wald $\chi^2 = 4.53$, $p = .012$) were more common among daily and non-daily cannabis users than among non-cannabis users. Smaller proportions of daily and non-daily cannabis users perceived great risk associated with regular cannabis use, as compared to non-cannabis users (Wald $\chi^2 = 12.51$, $p < .001$).

Medical Cannabis Use.—Medical cannabis users reported being White (96.6%) or Black (3.4%); medical cannabis users were more likely to be White as compared to recreational users (Wald $\chi^2 = 4.45$, $p = .011$; Table 3). Medical users were more likely than recreational

users to be married (Wald $\chi^2 = 10.79$, $p = .002$) and less likely to report past year alcohol use (Wald $\chi^2 = 8.89$, $p = .004$).

MULTINOMIAL LOGISTIC REGRESSION ANALYSES

In adjusted analyses, persons age 26–34 (aRRR = 0.36, 95% CI [0.15, 0.88]), 35–49 (aRRR = 0.26, 95% CI [0.13, 0.50]), and 50+ (aRRR = 0.34, 95% CI [0.14, 0.87]) were significantly less likely than persons age 18–25 to be non-daily cannabis users (Table 4). Individuals who were past-year substance users (aRRR = 2.04, 95% CI [1.17, 3.58]), current cigarette smokers (aRRR = 2.26, 95% CI [1.29, 3.97]), past-month binge drinkers (aRRR = 1.91, 95% CI [1.02, 3.56]), and had lifetime MDE (aRRR = 2.08, 95% CI [1.04, 4.13]) were significantly more likely to be non-daily cannabis users than non-cannabis users. Additionally, non-daily cannabis users were 83% less likely (95% CI [0.12, 0.60]) than non-cannabis users to perceive great risk associated with regular cannabis use. Current cigarette smokers (aRRR = 3.77, 95% CI [1.30, 10.91]) and individuals with lifetime MDE (3.19, 95% CI [1.46, 7.00]) were significantly more likely to be daily cannabis users than non-cannabis users. Daily cannabis users were also 90% less likely (95% CI [0.03, 0.42]) than non-cannabis users to perceive great risk of using cannabis on a regular basis.

DISCUSSION

Approximately one-third (34.9%) of PLWH in the NSDUH reported past-year cannabis use—nearly three times greater than what is observed in the U.S. general population (13.3%; Compton et al., 2016). Compared to what is observed in the general population (Compton et al., 2016), daily cannabis use (8.0% versus 3.5%) and CUD (5.6% versus 1.5%) were also reported with greater frequency among our sample. Past-year blunt use was also common, though less prevalent among PLWH cannabis users than estimates from the general population, (33.3% versus 66%; Fairman, 2015). Medical cannabis use was also more prevalent among HIV-positive cannabis users than in the 2013 general population (26.0% versus 17%; Lin, Ilgen, Jannausch, & Bohnert, 2016). Though our estimates should be interpreted with some caution given the small sample size, they are consistent with prior estimates of medical cannabis use in PLWH (D'Souza et al., 2012; Furler et al., 2004; Harris et al., 2014). Bivariate analyses revealed that medical cannabis users were more likely than recreational users to be White (Bach, Pham, Schrag, Tate, & Hargraves, 2004) married, and less likely to have used alcohol in the past year. These findings, though preliminary, suggest that medical cannabis users may represent a distinct subpopulation that is qualitatively different than recreational cannabis users among PLWH.

Consistent with prior research, (D'Souza et al., 2012; Harris et al., 2014) current cigarette smokers were more than twice as likely to be past-year non-daily cannabis users and almost 4 times as likely to be past-year daily cannabis users. The high prevalence of smoking and other tobacco use in PLWH has been well documented (Mdodo et al., 2015; Pacek, Harrell, & Martins, 2014; Pacek, Sweitzer, & McClernon, 2016). Given the high prevalence of comorbid use, attempts to improve respiratory health in this population with cessation interventions for either substance individually may be undermined by use of the other substance. The comorbid nature of cigarette smoking and cannabis use in this population

points to the need for novel public health tobacco control measures that take comorbid cannabis use into account, as well as integrated cigarette smoking and cannabis cessation interventions.

Consistent with prior research among adults in the U.S. (Lev-Ran et al., 2014; Pacek, Martins, & Crum, 2013), lifetime MDE was associated with increased likelihood of non-daily and daily cannabis use. HIV-positive cannabis users often report alleviation of anxiety and depression to be one of the primary benefits of cannabis use (Abrams et al., 2007; Furler et al., 2004; Haney et al., 2007; Prentiss et al., 2004); therefore a self-medication pathway could be at play. The association of cannabis use with depression points to a need for understanding underlying reasons for use in order to develop appropriate interventions and make clinical recommendations, given the common co-occurrence of substance use and mental health issues among HIV patients. Additionally, PLWH who perceived a great risk associated with regular cannabis use were 79% less likely to be current users than those who did not perceive great risk. The perceived risk of using cannabis has been on the decline in the U.S. (Compton et al., 2016; Pacek et al., 2015), and is associated with cannabis use (Compton et al., 2016). The ever-evolving legislation governing the medicalization and legalization of cannabis use within the U.S. likely plays a role in the decreasing perceived risk of using cannabis, and subsequent increases in actual use.

It is worth noting the possibility that at least some of the aforementioned outcomes associated with cannabis use in this population are driven by the amount of cannabis used, rather than use per se. For instance, some data suggest a dose-response relationship between level of cannabis use and risk of subsequent depression and suicide among young persons (Lev-Ran et al., 2014; Silins et al., 2014). Our findings are consistent with this notion: adjusted relative risk ratios for the association between lifetime MDE and cannabis use status were more robust for daily cannabis use than non-daily use. Similar patterns were observed for associations between use status and current cigarette smoking, as well as perceived great risk of regular cannabis use. Accumulating research highlighting the medicinal benefits of cannabis use among PLWH, coupled with the lack of guidelines or recommendations regarding medical cannabis use point to a need for increased research into recommendations for therapeutically beneficial levels of use, particularly in the face of increasing decriminalization and legalization of cannabis.

The present study has a number of limitations. All data were obtained by self-report, which may be biased due to stigma surrounding substance use and HIV status. However, the NSDUH utilizes ACASI, which has been shown to increase the likelihood of honest responding for sensitive information (Center for Behavioral Health Statistics and Quality, 2015). The NSDUH is a cross-sectional survey, which precludes our ability to make statements regarding the observed associations in terms of causality. Additionally, we are unable to assess longitudinal trends in cannabis use in PLWH due to the small sample sizes in any given survey year; however, survey year was included in adjusted models and was not a significant correlate of past-year cannabis use. Related to small sample size of PLWH, we also acknowledge the relatively wide confidence intervals associated with some covariates in the adjusted model. The NSDUH does not include questions about all forms and preparations of cannabis and cannabis products (e.g., tinctures, etc.), thus the prevalence of

cannabis use in PLWH may be underreported, especially in states with legalized cannabis use. Additionally, assessment of medical cannabis use in the NSDUH began only in 2013, limiting our ability to accurately assess medical cannabis use given the small sample size of PLWH in survey years 2013–2015 combined. Moreover, medical cannabis use was assessed with a single question, regarding whether any cannabis used within the past year was recommended by a doctor. This may not reflect individuals who possess a medical cannabis card and obtain their cannabis through medical dispensaries. NSDUH also does not include questions regarding reasons for cannabis use; though individuals may not have been prescribed cannabis by a health professional, it is possible that some are using it to self-medicate psychological or medical symptoms instead of, or in addition to, recreational cannabis use. NSDUH also does not collect clinical variables relevant to PLWH, such as year of diagnosis, mode of HIV infection, HIV treatment status, CD4+ cell count, viral load, or antiretroviral therapy adherence, leaving us unable to assess the associations between these characteristics and cannabis use. Despite this, NSDUH remains one of the only, to our knowledge, nationally representative surveys to collect information regarding self-reported HIV status and detailed information about cannabis use. Moreover, it continues to be administered annually, allowing for up to date estimates of the aforementioned factors.

CONCLUSIONS

The aforementioned limitations notwithstanding, this work has a number of strengths. To our knowledge, this study represents the first examination of non-daily and daily cannabis use, as well as medical cannabis use, in a nationally representative sample of PLWH. Findings are consistent with previous research among clinical samples of HIV-positive cannabis users, and help to establish that cannabis use is a significant public health issue among PLWH. Findings from the present paper add to the extant epidemiological data regarding the prevalence and correlates of cannabis use—frequency of use and medical use—among PLWH and have implications for the development of cannabis cessation interventions, as well as future cannabis research priorities.

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REFERENCES

- Abrams DI, Jay CA, Shade SB, Vizoso H, Reda H, Press S, ... Petersen KL (2007). Cannabis in painful HIV-associated sensory neuropathy: A randomized placebo-controlled trial. *Neurology*, 68, 515–521. 10.1212/01.wnl.0000253187.66183.9c [PubMed: 17296917]
- Allshouse AA, MaWhinney S, Jankowski CM, Kohrt WM, Campbell TB, & Erlandson KM (2015). The impact of marijuana use on the successful aging of HIV-infected adults. *Journal of Acquired Immune Deficiency Syndromes* (1999), 69, 187–192. 10.1097/QAI.0000000000000562 [PubMed: 25647530]
- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.
- Bach PB, Pham HH, Schrag D, Tate RC, & Hargraves JL (2004). Primary care physicians who treat blacks and whites. *New England Journal of Medicine*, 351, 575–584. 10.1056/NEJM-sa040609 [PubMed: 15295050]

- Bing EG, Burnam MA, Longshore D, Fleishman JA, Sherbourne CD, London AS, ... Shapiro M (2001). Psychiatric disorders and drug use among human immunodeficiency virus-infected adults in the United States. *Archives of General Psychiatry*, 58, 721–728. [PubMed: 11483137]
- Bonn-Miller MO, Oser ML, Bucossi MM, & Trafton JA (2014). Cannabis use and HIV antiretroviral therapy adherence and HIV-related symptoms. *Journal of Behavioral Medicine*, 37, 1–10. 10.1007/s10865-012-9458-5 [PubMed: 23054178]
- Budney AJ, Moore BA, Vandrey RG, & Hughes JR (2003). The time course and significance of cannabis withdrawal. *Journal of Abnormal Psychology*, 112, 393–402. [PubMed: 12943018]
- Budney AJ, Roffman R, Stephens RS, & Walker D (2007). Marijuana dependence and its treatment. *Addiction Science & Clinical Practice*, 4, 4–16. [PubMed: 18292704]
- Center for Behavioral Health Statistics and Quality. (2015). Behavioral health trends in the United States: Results from the 2014 National Survey on Drug Use and Health (HHS Publication No. SMA 15-4927). Retrieved from <https://www.samhsa.gov/data/sites/default/files/NSDUH-FRR1-2014/NSDUH-FRR1-2014.pdf>
- Centers for Disease Control and Prevention. (2016). Selected national HIV prevention and care outcomes in the United States. Retrieved from <https://www.cdc.gov/hiv/pdf/library/factsheets/cdc-hiv-national-hiv-care-outcomes.pdf>
- Compton WM, Han B, Jones CM, Blanco C, & Hughes A (2016). Marijuana use and use disorders in adults in the USA, 2002–14: Analysis of annual cross-sectional surveys. *Lancet Psychiatry*, 3, 954–964. 10.1016/S2215-0366(16)30208-5 [PubMed: 27592339]
- Cristiani SA, Pukay-Martin ND, & Bornstein RA (2004). Marijuana use and cognitive function in HIV-infected people. *Journal of Neuropsychiatry and Clinical Neurosciences*, 16, 330–335. 10.1176/jnp.16.3.330 [PubMed: 15377740]
- D'Souza G, Matson PA, Grady CD, Nahvi S, Merenstein D, Weber KM, ... Wilson TE (2012). Medicinal and recreational marijuana use among HIV-infected women in the Women's Interagency HIV Study (WIHS) cohort, 1994–2010. *Journal of Acquired Immune Deficiency Syndromes* (1999), 61, 618–626. 10.1097/QAI.0b013e318273ab3a [PubMed: 23011399]
- Ellis RJ, Toperoff W, Vaida F, van den Brande G, Gonzales J, Gouaux B, ... Atkinson JH (2009). Smoked medicinal cannabis for neuropathic pain in HIV: A randomized, crossover clinical trial. *Neuropsychopharmacology*, 34, 672–680. 10.1038/npp.2008.120
- Fairman BJ (2015). Cannabis problem experiences among users of the tobacco-cannabis combination known as blunts. *Drug and Alcohol Dependence*, 150, 77–84. 10.1016/j.drugalcdep.2015.02.014 [PubMed: 25746234]
- Furler MD, Einarson TR, Millson M, Walmsley S, & Bendayan R (2004). Medicinal and recreational marijuana use by patients infected with HIV. *AIDS Patient Care and STDs*, 18, 215–228. 10.1089/108729104323038892 [PubMed: 15142352]
- Gruber AJ, Pope HG, Hudson JI, & Yurgelun-Todd D (2003). Attributes of long-term heavy cannabis users: A case-control study. *Psychological Medicine*, 33, 1415–1422. [PubMed: 14672250]
- Haney M, Gunderson EW, Rabkin J, Hart CL, Vosburg SK, Comer SD, & Foltin RW (2007). Dronabinol and marijuana in HIV-positive marijuana smokers. Caloric intake, mood, and sleep. *Journal of Acquired Immune Deficiency Syndromes* (1999), 45, 545–554. 10.1097/QAI.0b013e31811ed205 [PubMed: 17589370]
- Harris GE, Dupuis L, Mugford GJ, Johnston L, Haase D, Page G, ... Dow G (2014). Patterns and correlates of cannabis use among individuals with HIV/AIDS in Maritime Canada. *Canadian Journal of Infectious Diseases & Medical Microbiology*, 25, e1–e7. [PubMed: 24634690]
- Hosek SG, Harper GW, & Domanico R (2005). Predictors of medication adherence among HIV-infected youth. *Psychology, Health & Medicine*, 10, 166–179. 10.1080/1354350042000326584
- Kuo W-H, Wilson TE, Weber KM, Madhava V, Richardson J, Delapenha R, & Des Jarlais D (2004). Initiation of regular marijuana use among a cohort of women infected with or at risk for HIV in the Women's Interagency HIV Study (WIHS). *AIDS Patient Care and STDs*, 18, 702–713. 10.1089/apc.2004.18.702 [PubMed: 15659881]
- Lev-Ran S, Roerecke M, Le Foll B, George TP, McKenzie K, & Rehm J (2014). The association between cannabis use and depression: A systematic review and meta-analysis of longitudinal

studies. *Psychological Medicine*, 44, 797–810. 10.1017/S0033291713001438 [PubMed: 23795762]

- Lin LA, Ilgen MA, Jannausch M, & Bohnert KM (2016). Comparing adults who use cannabis medically with those who use recreationally: Results from a national sample. *Addictive Behaviors*, 61, 99–103. 10.1016/j.addbeh.2016.05.015 [PubMed: 27262964]
- Lopez-Quintero C, Pérez de los Cobos J, Hasin DS, Okuda M, Wang S, Grant BF, & Blanco C (2011). Probability and predictors of transition from first use to dependence on nicotine, alcohol, cannabis, and cocaine: Results of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). *Drug and Alcohol Dependence*, 115, 120–130. 10.1016/j.drugalcdep.2010.11.004 [PubMed: 21145178]
- Lutge EE, Gray A, & Siegfried N (2013). The medical use of cannabis for reducing morbidity and mortality in patients with HIV/AIDS. *Cochrane Database of Systematic Reviews*, 2013(4), CD005175 10.1002/14651858.CD005175.pub3
- Macalino GE, Celentano DD, Latkin C, Strathdee SA, & Vlahov D (2002). Risk behaviors by audio computer-assisted self-interviews among HIV-seropositive and HIV-seronegative injection drug users. *AIDS Education and Prevention*, 14, 367–378. [PubMed: 12413183]
- Mdodo R, Frazier EL, Dube SR, Mattson CL, Sutton MY, Brooks JT, & Skarbinski J (2015). Cigarette smoking prevalence among adults with HIV compared with the general adult population in the United States: Cross-sectional surveys. *Annals of Internal Medicine*, 162, 335–344. 10.7326/M14-0954 [PubMed: 25732274]
- Mimiaga MJ, Reisner SL, Grasso C, Crane HM, Safren SA, Kitahata MM, ... Mayer KH (2013). 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. *American Journal of Public Health*, 103, 1457–1467. 10.2105/AJPH.2012.301162 [PubMed: 23763417]
- Pacek LR, Harrell PT, & Martins SS (2014). Cigarette smoking and drug use among a nationally representative sample of HIV-positive individuals: Smoking and drug use among HIV-positive individuals. *American Journal on Addictions*, 23, 582–590. 10.1111/j.1521-0391.2014.12145.x [PubMed: 25065609]
- Pacek LR, Martins SS, & Crum RM (2013). The bidirectional relationships between alcohol, cannabis, co-occurring alcohol and cannabis use disorders with major depressive disorder: Results from a national sample. *Journal of Affective Disorders*, 148, 188–195. 10.1016/j.jad.2012.11.059 [PubMed: 23260381]
- Pacek LR, Mauro PM, & Martins SS (2015). Perceived risk of regular cannabis use in the United States from 2002 to 2012: Differences by sex, age, and race/ethnicity. *Drug and Alcohol Dependence*, 149, 232–244. 10.1016/j.drugalcdep.2015.02.009 [PubMed: 25735467]
- Pacek LR, Sweitzer MM, & McClernon FJ (2016). Non-cigarette tobacco and poly-tobacco use among persons living with HIV drawn from a nationally representative sample. *Drug and Alcohol Dependence*, 162, 251–255. 10.1016/j.drugalcdep.2016.03.020 [PubMed: 27049581]
- Prentiss D, Power R, Balmas G, Tzuang G, & Israelski DM (2004). Patterns of marijuana use among patients with HIV/AIDS followed in a public health care setting. *Journal of Acquired Immune Deficiency Syndromes* (1999), 35, 38–45. [PubMed: 14707790]
- Seamon MJ, Fass JA, Maniscalco-Feichtl M, & Abu-Shraie NA (2007). Medical marijuana and the developing role of the pharmacist. *American Journal of Health-System Pharmacy*, 64, 1037–1044. 10.2146/ajhp060471 [PubMed: 17494903]
- Silins E, Horwood LJ, Patton GC, Fergusson DM, Olsson CA, Hutchinson DM, ... Cannabis Cohorts Research Consortium. (2014). Young adult sequelae of adolescent cannabis use: an integrative analysis. *Lancet Psychiatry*, 1, 286–293. 10.1016/S2215-0366(14)70307-4 [PubMed: 26360862]
- Slawson G, Milloy M-J, Balneaves L, Simo A, Guillemi S, Hogg R, ... Kerr T (2015). High-intensity cannabis use and adherence to antiretroviral therapy among people who use illicit drugs in a Canadian setting. *AIDS and Behavior*, 19, 120–127. 10.1007/s10461-014-0847-3 [PubMed: 25012624]
- StataCorp. (2011). *Stata Statistical Software: Release 12*. College Station, TX: StataCorp, LP.

- Stephens RS, Babor TF, Kadden R, Miller M, & Marijuana Treatment Project Research Group. (2002). The Marijuana Treatment Project: Rationale, design and participant characteristics. *Addiction* (Abingdon, England), 97, S109–S124.
- Vandrey RG, Budney AJ, Hughes JR, & Liguori A (2008). A within-subject comparison of withdrawal symptoms during abstinence from cannabis, tobacco, and both substances. *Drug and Alcohol Dependence*, 92, 48–54. 10.1016/j.drugalcdep.2007.06.010 [PubMed: 17643868]
- Volkow ND, Compton WM, & Weiss SRB (2014). Adverse health effects of marijuana use. *New England Journal of Medicine*, 371, 878–879. 10.1056/NEJMc1407928
- Wilson KJ, Doxanakis A, & Fairley CK (2004). Predictors for non-adherence to antiretroviral therapy. *Sexual Health*, 1, 251–257. [PubMed: 16335755]

TABLE 1.

Past-Year Cannabis use and Cannabis Abuse/Dependence Among Persons Living With HIV 18, NSDUH 2005–2015 (*N* = 626)

Characteristic	<i>n</i> (wt%)
Among total sample (<i>N</i> = 626)	
Any past-year cannabis use	245 (34.9)
Frequency of past-year cannabis use	
Nonuser	381 (65.1)
Non-daily user	193 (26.9)
Daily user	52 (8.0)
Past-year cannabis abuse/dependence	50 (5.6)
Among past-year users (<i>n</i> = 245)	
Frequency of past-year cannabis use	
Non-daily user	193 (77.1)
Daily user	52 (22.9)
Days used cannabis in past year—mean (<i>SD</i>)	135.9 (107.8)
Past-year blunt use	107 (33.3)
Past-year cannabis abuse/dependence	50 (16.1)
Any medical cannabis use *	15 (26.0)
Living in state with MML *	49 (58.1)

NSDUH = National Survey on Drug Use and Health.

* *n* = 95; questions about medical cannabis use were asked only in survey years 2013–2015.

TABLE 2.

Chi-Square Tests Assessing Differences Between Past-Year Daily and Non-daily Recreational Cannabis Users and Nonusers Among Persons Living With HIV Age 18, NSDUH 2005–2015 ($N = 626$)

Characteristic	Non-cannabis users ($n = 381$)	Non-daily cannabis use ($n = 52$)	Daily cannabis use ($n = 193$)
	n (wt% ^a)	n (wt% ^a)	n (wt% ^a)
Sex			
Male	270 (76.8)	151 (85.0)	41 (85.9)
Female	111 (23.2)	42 (15.0)	11 (14.1)
Age			
18–25	61 (3.6)	62 (4.6)	13 (3.6)
26–34	56 (12.9)	32 (26.5)	11 (12.9)
35–49	189 (44.2)	70 (43.9)	22 (44.2)
50+	78 (39.3)	29 (25.0)	6 (39.3)
Race/ethnicity			
White	159 (46.9)	100 (64.4)	27 (56.8)
Black	140 (30.3)	55 (26.9)	19 (25.3)
Hispanic	76 (21.9)	32 (8.3)	5 (17.0)
Other	6 (0.9)	6 (4.7)	1 (0.9)
Education			
< High school/GED	89 (20.0)	34 (32.4)	19 (11.2)
High school/GED	292 (80.0)	159 (67.6)	33 (88.8)
Marital status			
Not married	321 (81.7)	52 (100.0)	181 (91.3)
Married	60 (18.3)	0 (0.0)	12 (8.7)
Total family income			
\$0–19,999	159 (40.1)	66 (41.0)	27 (31.5)
\$20,000–39,999	94 (21.4)	47 (29.8)	12 (20.2)
\$40,000–74,999	67 (20.5)	44 (21.8)	6 (23.2)
\$75,000+	61 (18.0)	36 (7.4)	7 (25.1)
Past-year drug use ^b			
No	279 (76.1)	92 (52.0)	22 (53.8)
Yes	102 (23.9)	101 (48.0)	30 (46.2)
Current smoking			
No	241 (65.9)	84 (32.0)	16 (43.6)
Yes	139 (34.1)	109 (68.0)	36 (56.4)
Past year alcohol use			
No	125 (31.9)	20 (15.8)	7 (10.6)
Yes	256 (68.1)	173 (84.2)	45 (89.4)
Past month binge drinking			
No	280 (77.5)	100 (56.0)	27 (57.1)

Characteristic	Non-cannabis users (<i>n</i> = 381)	Non-daily cannabis use (<i>n</i> = 52)	Daily cannabis use (<i>n</i> = 193)
	<i>n</i> (wt% ^{<i>a</i>})	<i>n</i> (wt% ^{<i>a</i>})	<i>n</i> (wt% ^{<i>a</i>})
Yes	101 (22.5)	93 (44.0)	25 (42.9)
Lifetime MDE ^{<i>c</i>}			
No	290 (78.6)	126 (57.0)	32 (65.1)
Yes	91 (21.4)	67 (43.0)	20 (34.9)
Great risk of regular cannabis use			
No	253 (71.6)	178 (95.8)	48 (91.8)
Yes	120 (28.4)	15 (4.2)	4 (8.2)

Note. Bolded values indicate findings that are significantly different from those in the non-cannabis users category. NSDUH = National Survey on Drug Use and Health.

^{*a*} wt% = weighted percentage;

^{*b*} other than cannabis;

^{*c*} MDE = major depressive episode.

TABLE 3.

Chi-Square Tests Assessing Differences Between Past-Year Recreational and Medical Cannabis Users Among Persons Living With HIV Age 18, NSDUH 2013–2015 ($n = 95$)

Characteristic	Recreational cannabis users ($n = 80$)	Medical cannabis users ($n = 15$)
	n (wt% ^a)	n (wt% ^a)
Sex		
Male	60 (76.6)	12 (90.4)
Female	20 (23.4)	3 (9.6)
Age		
18–25	27 (17.3)	0 (0.0)
26–34	11 (15.1)	3 (9.7)
35–49	29 (27.0)	8 (47.1)
50+	13 (40.6)	4 (43.2)
Race/ethnicity		
White	31 (47.1)	14 (96.6)
Black	31 (31.7)	1 (3.4)
Hispanic	16 (19.2)	0 (0.0)
Other	2 (2.0)	0 (0.0)
Education		
< High school/GED	11 (9.2)	2 (6.9)
High school/GED	69 (90.8)	13 (93.1)
Marital status		
Not married	75 (98.0)	12 (73.6)
Married	5 (2.0)	3 (26.4)
Total family income		
\$0–19,999	33 (34.6)	5 (22.5)
\$20,000–39,999	13 (14.6)	4 (16.9)
\$40,000–74,999	16 (21.4)	5 (55.8)
\$75,000+	18 (29.4)	1 (4.8)
Past-year drug use ^b		
No	30 (45.4)	6 (43.8)
Yes	50 (54.6)	9 (56.2)
Current smoking		
No	43 (50.5)	6 (49.9)
Yes	37 (49.5)	9 (50.1)
Past year alcohol use		
No	6 (6.2)	5 (37.4)
Yes	74 (93.8)	10 (62.6)
Past month binge drinking		
No	44 (54.7)	10 (64.4)

Characteristic	Recreational cannabis users	Medical cannabis users
	(<i>n</i> = 80)	(<i>n</i> = 15)
	<i>n</i> (wt% ^{<i>a</i>})	<i>n</i> (wt% ^{<i>a</i>})
Yes	36 (45.3)	5 (35.6)
Lifetime MDE ^{<i>c</i>}		
No	58 (73.8)	8 (42.7)
Yes	22 (26.2)	7 (57.3)
Great risk of regular use		
No	74 (82.5)	14 (66.7)
Yes	6 (17.5)	1 (33.3)
Frequency of use		
Non-daily	66 (77.5)	11 (61.9)
Daily	14 (22.5)	4 (38.1)
Blunt use		
No	39 (60.3)	9 (64.1)
Yes	41 (39.7)	6 (35.9)
Cannabis use disorder		
No	68 (88.5)	12 (79.8)
Yes	12 (11.5)	3 (20.2)

Note. Bolded values indicate statistically significant findings. NSDUH = National Survey on Drug Use and Health.

^{*a*} wt% = weighted percentage;

^{*b*} other than cannabis;

^{*c*} MDE = major depressive episode.

TABLE 4.

Adjusted Multinomial Logistic Regression Analyses Describing the Association Between Participant Characteristics and Past-Year Recreational Cannabis Use Status Among Persons Living With HIV Age 18, NSDUH 2005–2015 ($N = 626$)

	Non-daily cannabis use vs. no use	Daily cannabis use vs. no use
	^a RRR (95% CI)	^a RRR (95% CI)
Sex		
Male	1.0	1.0
Female	0.60 (0.31, 1.19)	0.45 (0.14, 1.42)
Age		
18–25	1.0	1.0
26–34	0.36 (0.15, 0.88)	1.23 (0.40, 3.72)
35–49	0.26 (0.13, 0.50)	0.73 (0.31, 1.71)
50+	0.34 (0.14, 0.87)	0.61 (0.18, 2.06)
Education		
< High school/GED	1.0	1.0
High school/GED	1.83 (0.96, 3.50)	0.44 (0.15, 1.32)
Past-year drug use ^a		
No	1.0	1.0
Yes	2.04 (1.17, 3.58)	1.60 (0.72, 3.57)
Current smoking		
No	1.0	1.0
Yes	2.26 (1.29, 3.97)	3.77 (1.30, 10.91)
Past-month binge drinking		
No	1.0	1.0
Yes	1.91 (1.02, 3.56)	1.77 (0.69, 4.67)
Lifetime MDE ^b		
No	1.0	1.0
Yes	2.08 (1.04, 4.13)	3.19 (1.46, 7.00)
Great risk of regular use		
No	1.0	1.0
Yes	0.27 (0.12, 0.60)	0.10 (0.03, 0.42)
Survey year	0.98 (0.90, 1.08)	1.10 (0.96, 1.26)

Note. All variables in table included in the adjusted model. Bolded values indicate statistically significant findings. NSDUH = National Survey on Drug Use and Health.

^aOther than cannabis;

^bMDE = major depressive episode.