

# Medicinal and Recreational Marijuana Use Among HIV-Infected Women in the Women's Interagency HIV Study (WIHS) Cohort, 1994–2010

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**Background:** Despite the major benefits of effective antiretroviral therapy on HIV-related survival, there is an ongoing need to help alleviate medication side effects related to antiretroviral therapy use. Initial studies suggest that marijuana use may reduce HIV-related symptoms, but medical marijuana use among HIV-infected individuals has not been well described.

**Methods:** The authors evaluated trends in marijuana use and reported motivations for use among 2776 HIV-infected women in the Women's Interagency HIV Study between October 1994 and March 2010. Predictors of any and daily marijuana use were explored in multivariate logistic regression models clustered by person using generalized estimating equation. In 2009, participants were asked if their marijuana use was medical, "meaning prescribed by a doctor," or recreational, or both.

**Results:** Over the 16 years of this study, the prevalence of current marijuana use decreased significantly from 21% to 14%. In contrast, daily marijuana use almost doubled from 3.3% to 6.1% of all women and from 18% to 51% of current marijuana users. Relaxation, appetite improvement, reduction of HIV-related symptoms, and

social use were reported as common reasons for marijuana use. In 2009, most marijuana users reported either purely medicinal use (26%) or both medicinal and recreational usage (29%). Daily marijuana use was associated with higher CD4 cell count, quality of life, and older age. Demographic characteristics and risk behaviors were associated with current marijuana use overall but were not predictors of daily use.

**Conclusions:** This study suggests that both recreational and medicinal marijuana use are relatively common among HIV-infected women in the United States.

**Key Words:** marijuana, cannabis, HIV, medicinal  
(*J Acquir Immune Defic Syndr* 2012;61:618–626)

## INTRODUCTION

HIV-infected individuals experience a wide range of medical and psychiatric comorbidities, such as neuropathy, anxiety and depression, and adverse side effects associated with antiretroviral treatment.<sup>1–4</sup> Users of effective antiretroviral therapy (ART) experience a range of symptoms, including neuropathic pain, nausea, diarrhea, loss of appetite, disturbed sleep, depression and anxiety, and physical sickness; these factors are cited as a common reason for delaying, missing, and discontinuing doses of ART.<sup>5</sup> Despite the major benefits of ART on HIV-related survival,<sup>6</sup> there is an ongoing need to help alleviate medication side effects to ensure the long-term adherence to antiretroviral treatments that is necessary for optimal health outcomes.

Initial randomized controlled studies of HIV-infected individuals with peripheral neuropathy suggest significant reduction of pain with daily marijuana use compared with placebo.<sup>7,8</sup> The substance in marijuana thought to produce these beneficial effects is delta-9-THC. Several pharmaceutical oral formulations of delta-9-THC are currently Food and Drug Administration approved for treatment of loss of appetite in AIDS and chemotherapy-induced nausea and vomiting, using dronabinol (Marinol).<sup>3,9,10</sup> Although dronabinol (Marinol) has been approved for use in AIDS since 1992, the frequency of medical marijuana use among HIV-infected individuals has not been well studied.

Observation studies of HIV-infected individuals in the United States have reported that current marijuana use

Received for publication June 7, 2012; accepted September 10, 2012.

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The Women's Interagency HIV Study is funded by the National Institute of Allergy and Infectious Diseases (U01-AI-35004, U01-AI-31834, U01-AI-34994, U01-AI-34989, U01-AI-34993, and U01-AI-42590) and by the Eunice Kennedy Shriver National Institute of Child Health and Human Development (U01-HD-32632). The study is cofunded by the National Cancer Institute, the National Institute on Drug Abuse (NIDA), and the National Institute on Deafness and Other Communication Disorders. Funding is also provided by the National Center for Research Resources (UCSF-CTSI Grant Number UL1 R024131). Additional support includes: K23 DA025736 (NIDA to S.N.).

The authors have no conflicts of interest to disclose.

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is relatively common (12%–27%) and that its use may reduce HIV-related symptoms.<sup>3,8,11,12</sup> The prevalence of marijuana use in the general US population, by contrast, is between 3% and 7%.<sup>13,14</sup> In a Canadian study, where cannabis has been legal for medicinal use in HIV since 2001, 61% of HIV-infected individuals classified themselves as current medical cannabis users (defined in that study as using marijuana as a means to cope with their illness or symptoms).<sup>4</sup> The demand for medical marijuana seems to be significant, but given that medicinal use is illegal in the majority of the US states, this presents a challenge to the US drug policy.<sup>15</sup>

A previous study in the Women's Interagency HIV Study (WIHS), a multisite longitudinal observational study of HIV infection among the US women, reported a high prevalence (72%) of lifetime marijuana use.<sup>16</sup> Furthermore, a substantial subgroup currently used marijuana at least weekly, and 13% of the 2308 WIHS women who were not weekly marijuana users at study baseline initiated weekly use between 1994 and 2000.<sup>16</sup> We now extend this previous study to evaluate the longitudinal patterns of marijuana use and the predictors and motivators of use over a 16-year period during which effective ART came into common use. Because the use of marijuana among chronically ill persons seems to be frequent and ongoing in the United States, it is important to understand the factors that influence the use and the outcomes related to marijuana use.

## METHODS

### Study Population

The present study uses data from 2776 HIV-infected women who participated in the WIHS between October 1994 and March 2010 and answered questions on marijuana use. The WIHS participants were recruited from 6 study sites in the San Francisco Bay Area, southern California, Bronx, Brooklyn, Chicago, and Washington, DC.<sup>17,18</sup> Women were recruited in 1994–1995 and again in 2001–2002 from a variety of venues, including HIV care clinics and testing sites, community outreach, and research and drug rehabilitation programs. Of the 2776 HIV-infected women enrolled, 966 (35%) had died by 2010. Of the 1810 women still alive after up to 15 years of participation, 1377 (76%) were still actively participating in the study in 2010; retention strategies have been described elsewhere.<sup>19,20</sup>

### Measures

Interviewer-administered questionnaires are administered twice annually in the WIHS, and the data are routinely collected on the use of recreational and therapeutic drugs, alcohol, and cigarettes over the past 6 months (called *recent use* hereafter). Questions assess the prevalence and frequency of current marijuana use. Recent marijuana use was assessed by asking the participants the following question: "Since your last visit have you used marijuana or hash?" Frequency of use was assessed by asking, "On average, how often did you use

marijuana or hash since your last visit?" Validity of self-reported drug use has been shown in multiple studies,<sup>21</sup> although some studies suggest higher reporting of drug use using computer-assisted self-interview.<sup>22</sup>

Between 2004 and 2008, additional questions on reasons for marijuana use were added to the WIHS interview. Four specific reasons for marijuana use were queried at each visit between 2004 and 2008: to relax, for social situations, to reduce HIV symptoms, and to increase appetite (each yes/no answer). Respondents reporting marijuana use for other reasons were also asked to describe those reasons with open-text responses that were then grouped into meaningful categories. The range of reasons for use was similar at each visit, and therefore, only the cumulative prevalence of each reason was reported. Marijuana users on ART were also asked whether their marijuana affected how they took their ART medication (yes/no). In 2009, a question on medicinal marijuana use was added for all women reporting recent marijuana use; this question asked women whether their use of marijuana was "medical, meaning prescribed by a doctor, or recreational, or both."

Each study visit also included the collection of demographic, psychosocial, and biological variables and a physical examination and laboratory test, which include CD4 T-cell count and HIV viral load. The definition of ART was guided by the Department of Health and Human Services/Kaiser Panel<sup>23</sup> and is defined as the reported use of 3 or more antiretroviral medications, one of which has to be a protease inhibitor, a nonnucleoside reverse transcriptase inhibitor, an integrase inhibitor, or an entry inhibitor, with 1 of the nucleoside reverse transcriptase inhibitors, abacavir or tenofovir.

Covariates of interest included the following HIV-related variables: CD4 cell count tested at every visit (continuous), ART use in the past 6 months (yes, no), and, among those on ART, adherence to the regimen defined as a self-report of taking antiretroviral drugs as prescribed  $\geq 95\%$  of the time. In addition, we evaluated comorbidities, including self-reported peripheral neuropathy defined as "since your last visit have you experienced numbness, tingling or burning sensations in your arms, legs, hands or feet that lasted for more than two weeks"; self-reported asthma; symptoms of depression assessed via the Center for Epidemiological Studies Depression Scale (CES-D), where a CES-D  $\geq 16$  is defined as a high level of symptoms<sup>24</sup>; diabetes defined by self-report, taking diabetes medication, or having serum glucose  $> 125$ ; and self-reported quality of life (QOL) rated using a shortened Medical Outcome Study–HIV Health Survey, with scores ranging from 0 to 10,<sup>25,26</sup> where 6 or higher was defined as good perceived health. In addition, we asked about any use of tobacco, cocaine, and injection drug in the past 6 months and also the number of sexual partners in the past 6 months and condom use during the past 6 months (always, sometimes, never) as measures of sexual risk taking; and age. Race and ethnicity were categorized as white non-Hispanic, black non-Hispanic, other race non-Hispanic, and Hispanic any race. As results were similar for Hispanics of any race and white non-Hispanics, they were grouped together in the final analyses. Institutional review

board approval was obtained at each study site, and the informed consent was obtained from each participant.

## Statistical Analysis

We describe the characteristics of participants at the study baseline (which was 1994–1995 for 74% of the women and was 2001–2002 for the remaining women) and in 2010. The prevalence of current marijuana use was plotted over calendar time.

Univariate and multivariate logistic regression models clustered by person using generalized estimating equation were used to evaluate the risk factors for current marijuana use (defined as marijuana use since the last visit) at semiannual visits between 1994 and 2010. Three separate models were considered as outcomes: (1) any current marijuana use (yes/no); (2) current daily marijuana use (daily compared with <daily or no use); and (3) current marijuana use among marijuana users (daily compared with <daily use). Heavy marijuana use was defined as daily marijuana use in the past 6 months.<sup>27,28</sup> We were especially interested in the association between ART use/adherence and marijuana use, as marijuana use has been reported to help alleviate some ART-related side effects and might therefore increase adherence. At each visit, covariates of interest at the same visit were compared with marijuana use at that visit. These models included the following time-updated variables: age; CD4 cell count; HIV status; ART use in the past 6 months; ART adherence; current peripheral neuropathy; asthma; depression symptoms; diabetes; QOL; current tobacco, cocaine, and injection drug use; recent number of sexual partners; and recent condom use. Race and ethnicity, study site, and enrollment wave into study were also included in these models. Univariate odds ratio and adjusted odds ratios (aORs) and 95% confidence intervals (95% CI) were reported. All variables significant in univariate analysis ( $P < 0.10$ ) and variables of a priori interest were included in the multivariate models and removed in a stepwise fashion. Final multivariate models for each outcome retained all statistically significant variables and also those variables of interest from previous research (including age, race, current CD4 count, current ART use, depression, and ART adherence) and variables significant in the other outcome models for comparison. The association of current marijuana use (as an exposure) on increased odds of ART adherence (as an outcome) was similarly modeled. All analysis was performed using Stata 11.

## RESULTS

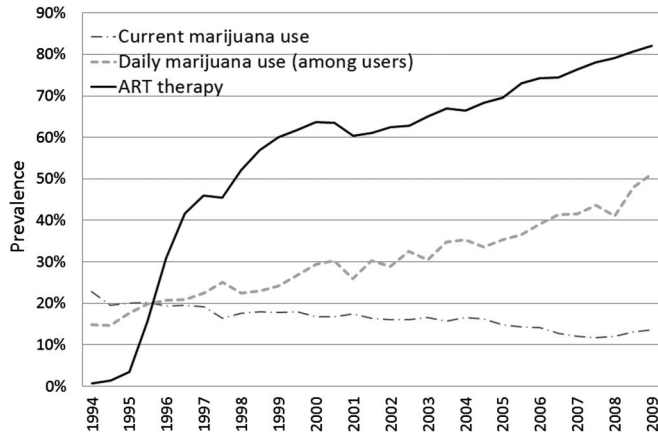
### Characteristics of the Study Population at Enrollment

A total of 2776 HIV-infected women were enrolled in the WIHS in the 2 enrollment waves (1994–1995 and 2001–2002) and completed baseline study surveys. Participants were primarily black non-Hispanic (56%), Hispanic (26%), and white non-Hispanic (15%, Table 1). At enrollment, the median age was 35.6 years, 66.5% reported ever having used

**TABLE 1.** Characteristics of HIV-Infected WIHS Participants at Study Entry and in 2010

Characteristic	Baseline (n = 2776) n (%)	Visit 31 (Oct 2009–Mar 2010) (N = 1377) n (%)
Median age, yr	36	46
Year enrolled		
1994–1995	2044 (74)	846 (61)
2001–2002	732 (26)	531 (39)
Race and ethnicity		
White (Non-Hispanic)	423 (15)	188 (14)
African American (Non-Hispanic)	1547 (56)	752 (55)
Hispanic ethnicity, any race	716 (26)	385 (28)
Asian/Pacific Islander/other	90 (3)	52 (4)
Comorbidities and QOL		
Median HIV viral load, units	12,000	Undetectable
Median CD4 cell count, units	372	497
Currently on HAART	403 (15)	1131 (82)
Have peripheral neuropathy	702 (25)	277 (20)
Have asthma	526 (19)	61 (4)
Depressed (CES-D $\geq$ 16)	1473 (53)	380 (31)
Report good QOL	1639 (59)	721 (57)
Risk behavior in past 6 months		
Used tobacco	1420 (51)	460 (37)
Used cocaine	323 (12)	14 (1.1)
Injected drugs	224 (8)	7 (0.6)
No. sexual partners		
0	756 (27)	291 (40)
1	1549 (56)	685 (55)
$\geq$ 2	456 (17)	64 (5)
Used marijuana or hash?	594 (21)	170 (14)
Frequency of marijuana use (among users)		
Less than once a month	173 (29)	20 (12)
>Once a month, but $\leq$ once a week	186 (31)	30 (17)
2–6 times a week	128 (22)	33 (19)
Once a day	59 (10)	31 (18)
More than once a day	46 (8)	56 (33)

marijuana and 21.4% reported marijuana use in the past 6 months. At study baseline, current marijuana use varied by study site from 16%–19% of participants at the Washington, DC, Los Angeles, and Brooklyn sites to 25%–29% of participants at the Bronx, Chicago, and San Francisco sites, respectively ( $P < 0.001$ ). Heavy (daily) marijuana use at baseline was uncommon (3.8% of all participants); half (50%) of current marijuana users reported only occasional (less than weekly) use, 33% reported weekly use, and only 18% reported daily use (Table 1). There were 43,540 person visits included in this analysis, with a median of 16 visits per woman (interquartile range = 6–26), and a median of 6 months between the study visits.



**FIGURE 1.** Prevalence of current marijuana use (any and daily use), and prevalence of antiretroviral therapy (ART) among HIV-infected women in the WIHS, 1994–2010.

**Trends in Marijuana Use Among HIV-Infected Women, 1994–2010**

Over the 16 years of this study, the prevalence of current marijuana use decreased significantly from 23% to 14% ( $P < 0.001$ , Fig. 1), as participants aged. This included a decrease in marijuana use among both HIV-infected women on ART (22%–12%) and HIV-infected women not on ART (22%–15%). In contrast, the occurrence of daily marijuana use almost doubled over the same time period, from 3.3% to 6.1% of all women. Among current marijuana users, the increase in daily marijuana was even more dramatic, changing from 14.8% of current marijuana users at study entry to 51% of current marijuana users in 2010 ( $P$ -trend  $\leq 0.001$ , Fig. 1).

Daily marijuana use increased significantly during the course of the study at each of the study sites. This increase was most notable in the San Francisco study site where daily marijuana use increased from 5.1% of all participants in 1994 to 14.3% in 2010; at the other study sites, prevalence of daily marijuana use increased from 1.7%–4.5% of all women at baseline to 2.8%–6.9% of women in 2010. During the study, the proportion of HIV-infected women currently using marijuana also varied considerably by site ( $P < 0.001$ ). The average prevalence of current marijuana during the 14-year period of the study was 27% in San Francisco, 19% in Chicago, and 12%–15% in the remaining 4 sites.

**Reported Reasons for Current Marijuana Use**

In 2009–2010, marijuana users were asked whether their use was recreational or medicinal (defined in the survey as being prescribed by a doctor). The majority of marijuana users reported some medicinal marijuana use, including 26% of users reporting purely medicinal use and another 29% of users reporting both medicinal and recreational usage (Table 2). Medicinal marijuana use was even more common among heavy marijuana users; among daily marijuana users, more than two-thirds reported some medicinal marijuana use (Table 2). Although medicinal marijuana use was common among HIV-infected marijuana users, it remained rare in the study population overall, with 7.1% of women at the 2010 study visit reporting current medicinal marijuana use.

More general reasons for marijuana use were asked between 2004 and 2008, with participants asked to indicate all reasons that applied to their marijuana use. The most common reasons reported for marijuana use were: relaxation

**TABLE 2.** Self-Reported Reasons for Current Marijuana Use (Any and Daily Use) Among HIV-Infected Women in the WIHS Who Reported Marijuana Use in the Past 6 Months at Their V31 Study Visit (October 2009–March 2010)

Reasons Reported for Current Marijuana Use	Any Current Marijuana Use	Current Daily Marijuana Use
Among those using marijuana in past 6 months (at V31)	N = 170	N = 87
Was your use of marijuana medical, meaning prescribed by a doctor, or recreational?		
Recreational only, %	45	31
Medical only, %	26	28
Both medical and recreational, %	29	41
Does your use of marijuana affect how you take your HIV medication?		
No, %	98.5	98.4
Yes, %	1.5	1.6
Among those reporting recent marijuana use at any visit 2004–2008	N = 419	N = 208
Of the marijuana you consumed, did you use it for any of the following?		
To relax or reduce stress, %	85	82
To increase appetite because of weight loss, %	58	76
To reduce HIV symptoms such as nausea, %	38	52
To better appreciate a social situation, %	41	44
Additional reasons reported as motivators for use		
Recreational use, %	16	2
Physical pain relief, %	16	6
Mental health relief, %	8	0
Sleep aid, %	4	3

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**TABLE 3.** Longitudinal Analysis of the Risk Factors Associated With Current and Daily Marijuana Use Among 2776 HIV-Infected Women in the WIHS between 1994 and 2010

Risk Factors	Prevalence of Any Marijuana Use Across All Visits, %	OR (95% CI)				
		Any Current Marijuana Use		Current Daily Marijuana Use		
		Univariate	Multivariate	Univariate	Multivariate	Multivariate (Among Marijuana Users Only)
Current CD4 cell count						
<500	17.20	1.00	1.00	1.00	1.00	1.00
≥500	15.70	<b>0.84 (0.75 to 0.94)</b>	0.97 (0.85 to 1.10)	1.10 (0.94 to 1.30)	<b>1.21 (1.00 to 1.44)</b>	<b>1.24 (1.01 to 1.53)</b>
Currently on ART						
No	19.80	1.00	1.00	1.00	1.00	1.00
Yes	14.10	<b>0.55 (0.50 to 0.61)</b>	<b>0.77 (0.68 to 0.87)</b>	1.09 (0.95 to 1.27)	1.00 (0.84 to 1.20)	1.16 (0.96 to 1.42)
Adherent to ART (among ART users)*						
No (<95% of the time)	19.60	1.00	1.00	1.00	1.00	1.00
Yes (≥95% of the time)	12.40	<b>0.54 (0.46 to 0.64)</b>	<b>0.58 (0.48 to 0.71)</b>	<b>0.72 (0.57 to 0.91)</b>	0.81 (0.61 to 1.07)	1.24 (0.90 to 1.71)
Comorbidities						
Peripheral neuropathy						
No	15.80	1.00	1.00	1.00	1.00	1.00
Yes	20.00	<b>1.18 (1.05 to 1.32)</b>	<b>1.16 (1.02 to 1.32)</b>	1.13 (0.96 to 1.34)	1.12 (0.92 to 1.36)	1.03 (0.83 to 1.30)
Asthma						
No	16.20	1.00	1.00	1.00	1.00	1.00
Yes	24.50	<b>1.48 (1.25 to 1.74)</b>	<b>1.24 (1.01 to 1.51)</b>	<b>1.22 (0.94 to 1.59)</b>	1.32 (0.97 to 1.79)	1.18 (0.84 to 1.68)
Depressed						
No	13.90	1.00	1.00	1.00	1.00	1.00
Yes	20.10	<b>1.50 (1.36 to 1.65)</b>	<b>1.35 (1.19 to 1.52)</b>	<b>1.40 (1.19 to 1.64)</b>	<b>1.36 (1.14 to 1.62)</b>	1.16 (0.94 to 1.43)
Good QOL reported						
No	20.50	1.00	1.00	1.00	1.00	1.00
Yes	15.00	<b>0.88 (0.86 to 0.91)</b>	<b>0.81 (0.72 to 0.92)</b>	<b>0.84 (0.72 to 0.99)</b>	<b>1.35 (1.09 to 1.68)</b>	<b>1.33 (1.08 to 1.63)</b>
Body mass index						
Underweight (<18.5)	28.90	<b>1.61 (1.24 to 2.08)</b>	<b>1.47 (1.09 to 2.00)</b>	<b>1.97 (1.36 to 2.85)</b>	<b>1.88 (1.25 to 2.81)</b>	<b>1.56 (1.07 to 2.52)</b>
Normal (18.5–25)	20.60	1.00	1.00	1.00	1.00	1.00
Overweight (25–30)	15.40	<b>0.53 (0.46 to 0.61)</b>	<b>0.58 (0.50 to 0.68)</b>	<b>0.65 (0.53 to 0.80)</b>	<b>0.73 (0.58 to 0.91)</b>	0.89 (0.69 to 1.13)
Obese (>30)	12.30	<b>0.29 (0.24 to 0.35)</b>	<b>0.36 (0.29 to 0.44)</b>	<b>0.50 (0.38 to 0.66)</b>	0.54 (0.40 to 0.73)	0.97 (0.70 to 1.33)
Risk behaviors						
Current tobacco use						
No	9.60	1.00	1.00	1.00	1.00	1.00
Yes	24.60	<b>4.29 (3.69 to 5.00)</b>	<b>3.24 (2.74 to 3.83)</b>	<b>2.13 (1.74 to 2.60)</b>	<b>1.96 (1.54 to 2.47)</b>	0.94 (0.72 to 1.24)
Current cocaine use						
No	15.40	1.00	1.00	1.00	1.00	1.00
Yes	46.50	<b>5.07 (4.22 to 6.09)</b>	<b>3.63 (2.96 to 4.53)</b>	<b>1.66 (1.25 to 2.19)</b>	<b>1.55 (1.12 to 2.14)</b>	0.75 (0.54 to 1.05)
Number of sex partners in past 6 mo						
0	13.70	1.00	1.00	1.00	1.00	1.00
1	15.40	<b>1.64 (1.45 to 1.83)</b>	<b>1.34 (1.16 to 1.56)</b>	1.14 (0.95 to 1.36)	1.00 (0.76 to 1.31)	1.00 (0.76 to 1.30)
2–3	40.00	<b>3.09 (2.64 to 3.62)</b>	<b>2.11 (1.73 to 2.57)</b>	<b>1.36 (1.07 to 1.75)</b>	0.98 (0.69 to 1.37)	0.97 (0.69 to 1.37)
≥4	47.00	<b>9.62 (7.36 to 12.6)</b>	<b>5.06 (3.65 to 7.02)</b>	<b>1.80 (1.19 to 2.72)</b>	0.74 (0.49 to 1.29)	0.74 (0.44 to 1.24)
Condom use in past 6 mo						
Always/no sex	14.50	1.00	1.00	1.00	1.00	1.00
Sometimes	22.10	<b>1.91 (1.69 to 2.17)</b>	<b>1.41 (1.21 to 1.65)</b>	<b>1.43 (1.18 to 1.75)</b>	<b>1.46 (1.17 to 1.82)</b>	<b>1.32 (1.03 to 1.69)</b>
Never	23.90	<b>1.44 (1.23 to 1.68)</b>	<b>1.34 (1.11 to 1.62)</b>	<b>1.48 (1.17 to 1.87)</b>	<b>1.70 (1.31 to 2.20)</b>	<b>1.45 (1.10 to 1.93)</b>
Demographics						
Age, per 10-yr increase		<b>0.61 (0.55 to 0.66)</b>	<b>0.73 (0.66 to 0.81)</b>	<b>1.31 (1.17 to 1.47)</b>	<b>1.30 (1.13 to 1.49)</b>	<b>1.50 (1.28 to 1.75)</b>

**TABLE 3.** (Continued) Longitudinal Analysis of the Risk Factors Associated With Current and Daily Marijuana Use Among 2776 HIV-Infected Women in the WIHS between 1994 and 2010

Risk Factors	Prevalence of Any Marijuana Use Across All Visits, %	OR (95% CI)				
		Any Current Marijuana Use		Current Daily Marijuana Use		
		Univariate	Multivariate	Univariate	Multivariate	Multivariate (Among Marijuana Users Only)
<b>Race</b>						
White (NH), Hispanic	15.40	1.00	1.00	1.00	1.00	1.00
Other						
African American (NH)	17.60	<b>1.44 (1.0 to 1.9)</b>	<b>1.36 (0.98 to 1.88)</b>	<b>1.48 (1.01 to 2.15)</b>	<b>1.68 (1.08 to 2.61)</b>	1.37 (0.90 to 2.01)
<b>Site</b>						
Chicago, Ill	18.80	1.00	1.00	1.00	1.00	1.00
Bronx, NY	15.40	<b>0.56 (0.33 to 0.96)</b>	0.69 (0.41 to 1.15)	1.74 (0.88 to 3.42)	1.86 (0.91 to 3.81)	<b>3.28 (1.66 to 6.51)</b>
Brooklyn, NY	13.70	<b>0.30 (0.17 to 0.53)</b>	<b>0.43 (0.25 to 0.72)</b>	0.97 (0.47 to 2.02)	1.23 (0.58 to 2.62)	<b>2.77 (1.33 to 5.75)</b>
Washington, DC	11.80	<b>0.23 (0.13 to 0.43)</b>	<b>0.38 (0.22 to 0.68)</b>	<b>0.36 (0.14 to 0.93)</b>	0.45 (0.18 to 1.18)	0.88 (0.39 to 2.04)
Los Angeles, Calif	14.60	<b>0.33 (0.19 to 0.58)</b>	0.71 (0.42 to 1.20)	1.03 (0.50 to 2.09)	1.70 (0.79 to 3.63)	<b>2.82 (1.39 to 5.72)</b>
San Francisco, Calif	27.10	<b>2.64 (1.52 to 4.58)</b>	<b>3.06 (1.80 to 5.20)</b>	<b>5.26 (2.68 to 10.3)</b>	<b>5.48 (2.70 to 11.13)</b>	<b>3.51 (1.80 to 6.77)</b>

\*Effect of ART adherence was calculated in a separate model including only ART users. Measures with *p* values < 0.05 are indicated in bold. NH, non-Hispanic.

(85% of current marijuana users), appetite stimulation (58%), for social situations (41%), and for reduction of HIV symptoms (38%). Less common reasons reported for use included recreational use, physical pain relief, for mental health reasons, and as a sleep aid (Table 2). Among those using marijuana daily, use for relaxation and social situations were also common (Table 2). However, daily marijuana users were more likely than less frequent marijuana users to report the use for appetite stimulation (76% vs 49%, *P* < 0.001) or for reduction of HIV symptoms (52% vs 31%, *P* < 0.001). Marijuana users consistently reported that their marijuana use did not affect how they took their HIV medications.

### Factors Associated With Marijuana Use in Longitudinal Analysis

Table 3 explores the risk factors for current and daily marijuana use in longitudinal multivariate models of the data collected between 1994 and 2010. These models are adjusted for time-updated measures of current CD4 cell count, ART use and adherence, age, peripheral neuropathy, asthma, depression, QOL, body mass index, tobacco use, cocaine use, number of recent sexual partners, recent condom use, race and ethnicity, and study site. Current marijuana users at each visit were significantly less likely than nonusers to be on ART (aOR = 0.77, 95% CI = 0.68 to 0.87) and less likely to be adherent to ART (aOR = 0.58, 95% CI = 0.48 to 0.71). Current marijuana use was also associated with demographic factors, underweight and comorbidity, and other risk behaviors (Table 3).

The risk factors for heavy (daily) marijuana use were different from predictors for any marijuana use. These

differences were observed both when daily marijuana users were compared with all other women, and when daily marijuana users were compared with less frequent marijuana users only (Table 3). In contrast to the associations seen for any marijuana use, daily marijuana use was not associated with most other risk behaviors and was associated with older instead of younger age. Daily marijuana use was also significantly associated with higher current CD4 cell count and improved QOL (Table 3).

### Factors Associated With ART Adherence in Longitudinal Analysis

In multivariate longitudinal analysis, current marijuana users were significantly less likely to be adherent to ART (aOR = 0.60, 95% CI = 0.50 to 0.71). These models were adjusted for time-updated measures of current CD4 cell count, age, depression, QOL, body mass index, tobacco use, number of recent sexual partners, race and ethnicity, and study site. In contrast, daily marijuana use was not significantly associated with ART adherence (aOR = 0.85, 95% CI = 0.65 to 1.09, *P* = 0.22). Furthermore, among marijuana users currently on ART, daily marijuana users had significantly increased ART adherence compared with more casual marijuana users (aOR = 1.37, 95% CI = 1.03 to 1.83, *P* = 0.03).

### DISCUSSION

This cohort study evaluated marijuana use and related reasons for use every 6 months over 16 years in a large multisite study of HIV-infected women in the United States. The study demonstrates that marijuana use is common among HIV-infected women in the United States, including

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both recreational and medicinal marijuana use. Although the prevalence of marijuana use decreased during the study follow-up as participants aged, an increasing proportion of HIV-infected women using marijuana in the study also began using marijuana daily. These heavy users reported using marijuana primarily for medicinal purposes, suggesting that the rationale for marijuana use among HIV-infected women in this HAART-era study may have changed from purely recreational to a combination of recreational and medicinal usage.

The prevalence of current marijuana use in this multicenter cohort of HIV-infected women in the United States was similar to that reported in several other US studies,<sup>12,29</sup> although it was lower than a Canadian study, which reported 43% of HIV-infected participants used marijuana recently.<sup>30</sup> A previous study of marijuana use in this same WIHS cohort had a lower prevalence of current marijuana use than this study because they had excluded women with a history of daily marijuana use before the study baseline.<sup>16</sup> The increasing use of medical marijuana among HIV-infected women in this study is consistent with the previous studies showing medicinal use in the majority of HIV-infected marijuana users.<sup>12,29,30</sup> In the most recent data in this study, some medicinal marijuana use was reported by 55% of current marijuana users, similar to other US studies that reported medical use in 45%–67% of HIV-infected marijuana users.<sup>29,30</sup> Despite high rates of recreational marijuana use, current rates of medically prescribed marijuana use remained uncommon overall, reported by 7.1% of HIV-infected women in 2010 in the current study; other studies reported a higher prevalence (10%–29%) of current medicinal marijuana use among HIV-infected individuals,<sup>3,11,29–31</sup> but this may in part be explained by our definition of medicinal marijuana use as being prescribed by a doctor. Many women who reported using marijuana that was not medically prescribed indicated relief of HIV-related symptoms or increasing appetite as a motivator for use (ie, self-prescribed medicinal usage).

There was substantial variation in marijuana use between the 6 US study sites. These differences may reflect differing state laws and availability of any marijuana and medically prescribed marijuana. In California, which had the highest prevalence and increase in medicinal marijuana use during the study, medical marijuana became legal in 1996. Medicinal marijuana was not legalized in the other states in this study during the study period, although in Washington, DC, medicinal marijuana did become legal in 2010. A recent study suggested that states with legal medical marijuana use have a higher prevalence of marijuana use but that the percentage of marijuana users with marijuana dependence/abuse was similar in states with and without laws allowing medical marijuana use.<sup>14</sup> However, variation in study recruitment strategies between sites may also contribute to the observed differences as some venue-based recruitment may have targeted drug users at risk for HIV infection.

Reported reasons for marijuana use were similar to previous studies, with stress reduction and appetite stimulation as the most commonly reported reasons for use.<sup>29,30</sup> Although many women reported using marijuana for social and relaxation

reasons, marijuana use for symptom relief was also noted as an important motivator among these HIV-infected women. Reasons for marijuana use in this study were also consistent with previously reported studies showing appetite stimulation, reduction of pain, relaxation/social use, anxiety reduction, and help with sleep.<sup>4,29,30,32</sup> Research supports the utility of marijuana in reducing these symptoms with improvements in appetite, nausea, anxiety, depression, tingling, weight loss, and tiredness reported from marijuana use in other observational studies of HIV-infected individuals.<sup>3,11,30</sup> If cannabinoids are proven to reduce these ART-related side effects, medicinal marijuana use may become an increasingly important option for HIV-infected individuals, where laws allow its use. Indeed, recent randomized placebo controlled trials of HIV-infected individuals demonstrated significant reduction in neuropathy-associated pain<sup>7,8</sup> and improved appetite<sup>33,34</sup> from smoked cannabis, supporting its utility. As more HIV-infected individuals initiate ART treatment early and remain on treatment for long periods, reduction of ART-associated morbidity is increasingly important.

Adherence to ART was lower among current marijuana users than nonusers in this study, consistent with the previous research.<sup>35</sup> However, ART adherence was not reduced among the more consistent daily marijuana users. These results are similar to those observed in a previous study of 168 HIV-infected patients on ART in California who reported an increase in ART adherence among daily marijuana users, despite decreased adherence among marijuana users overall.<sup>36</sup> It seems that for some women, regular marijuana use reduces HIV-associated symptoms and does not impair adherence to ART. Multiple patterns of use are present in the cohort, ranging from highly adherent regular marijuana users to higher-risk women whose marijuana use may be associated with use of other drugs and higher-risk sexual behaviors. The association of recent sexual behavior and drug use with recent marijuana use observed in this study has been shown in many other studies,<sup>37</sup> as risk behaviors are often correlated. The fact that sex and drug use behavior were not associated with *daily* marijuana use in this study underscores the different nature of daily marijuana use and is consistent with the interpretation that some of daily marijuana use is medicinal rather than recreational.

There are several limitations and strengths to the current study. Validity of self-reported drug use has supported in multiple studies,<sup>38,39</sup> although some studies suggest that risk behaviors are underreported compared with use of computer-assisted self-interview.<sup>22</sup> Whether marijuana use was medicinal or recreational was only specifically asked in 2009, and therefore, the trend in medicinal marijuana use could not be evaluated. However, earlier surveys did ask about other questions related to reasons for marijuana use, and as the frequency of marijuana use was collected longitudinally, the trends in daily marijuana use could be explored. Marijuana abuse/dependence was not assessed. In addition, this was an observation study so marijuana users were self-selected (not assigned), and this study did not assess the efficacy or safety of marijuana use. Furthermore, we analyzed the changes in marijuana use at cohort level (not the changes within individuals); we cannot rule out the possibility that immigrative or

emigrative selection bias might in part explain the changes in marijuana use observed in the cohort.

Our study demonstrates that marijuana use is common among a representative group of US women living with HIV and that daily marijuana use did not decrease ART adherence. Furthermore, marijuana use was reported by many users to alleviate HIV-related symptoms. Given this pattern, which seems to be part of a broad trend toward use of marijuana in chronic illness, additional research is needed on the optimal formulation, efficacy, effectiveness, and safety of this patient-led treatment.

### ACKNOWLEDGMENTS

Data in this article were collected by the Women's Interagency HIV Study collaborative Study Group with centers (Principal Investigators) at New York City/Bronx Consortium (Kathryn Anastos); Brooklyn, NY (Howard Minkoff); Washington, DC, Metropolitan Consortium (Mary Young); the Connie Wofsy Study Consortium of Northern California (Ruth Greenblatt); Los Angeles County/Southern California Consortium (Alexandra Levine); Chicago Consortium (Mardge Cohen); Data Coordinating Center (Stephen Gange). The contents of this publication are solely the responsibility of the authors and do not necessarily represent the official views of the National Institutes of Health.

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