

No Detectable Association Between Frequency of Marijuana Use and Health or Healthcare Utilization Among Primary Care Patients Who Screen Positive for Drug Use

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BACKGROUND: Marijuana is the most commonly used illicit drug, yet its impact on health and healthcare utilization has not been studied extensively.

METHODS: To assess the cross-sectional association between frequency of marijuana use and healthcare utilization (emergency department and hospitalization) and health (comorbidity, health status), we studied patients in an urban primary care clinic who reported any recent (past 3-month) drug use (marijuana, opioids, cocaine, others) on screening. Frequency of marijuana use in the past 3 months was the main independent variable [daily/ almost daily, less than daily and no use (reference group)]. Outcomes assessed were past 3-month emergency department or hospital utilization, the presence of medical comorbidity (Charlson index ≥ 1), and health status with the EuroQol. We used separate multivariable regression models adjusting for age, sex, tobacco and other substance use.

RESULTS: All 589 participants reported recent drug use: marijuana 84 % (29 % daily, 55 % less than daily), cocaine 25 %, opioid 23 %, other drugs 8 %; 58 % reported exclusive marijuana use. Frequency of marijuana use was not significantly associated with emergency department use [adjusted odds ratio [AOR] 0.67, [95 % confidence interval (CI) 0.36, 1.24] for daily; AOR 0.69 [95 % CI 0.40, 1.18] for less than daily versus no use], hospitalization [AOR 0.79 (95 % CI 0.35, 1.81) for daily; AOR 1.23 (95 % CI 0.63, 2.40) for less than daily versus no use], any comorbidity [AOR 0.62, (95 % CI 0.33, 1.18) for daily; AOR 0.67 (95 % CI 0.38, 1.17) for less than daily versus no use] or health status (adjusted mean EuroQol 69.1, 67.8 and 68.0 for daily, less than daily and none, respectively, global $p=0.78$).

CONCLUSIONS: Among adults in primary care who screen positive for any recent illicit or non-medical prescription drug use, we were unable to detect an association between frequency of marijuana use and health, emergency department use, or hospital utilization.

KEY WORDS: marijuana; primary care; health status; health service utilization.

J Gen Intern Med 29(1):133-9

DOI: 10.1007/s11606-013-2605-z

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INTRODUCTION

Marijuana is the illicit drug most commonly used by patients in primary care identified by screening,¹ and it is the third most frequent drug on which people are dependent after alcohol and tobacco.² Two percent of the U.S. population meet criteria for cannabis dependence, and there is a lifetime prevalence of dependence of 4–8 %.³ Most of those who develop cannabis dependence have concurrent alcohol and tobacco dependence.² However, many people who smoke marijuana do not perceive it to be a major health problem.¹

Marijuana use has been associated with adverse health consequences,⁴ such as respiratory tract infections,⁵ small airway obstruction,⁶ lung, head and neck, and brain cancers,^{7–9} coronary heart disease¹⁰ and motor vehicle accidents.¹¹ It has also been linked to HIV risk behaviors in those with and without HIV infection,¹² and increased mortality risk in patients following inpatient detoxification.¹³ Nevertheless, there is no evidence that smoking marijuana increases mortality in the general population,¹¹ and many non-dependent marijuana users have no associated medical problems.¹⁴

Marijuana use is associated with a higher risk of psychotic symptoms⁴ and is linked to an earlier onset of psychotic disorders.¹⁵ Although epidemiological studies have shown associations between indices of heavy cannabis use and both depressive and anxiety disorder symptoms,¹⁶ evidence for a causal role of marijuana has been lacking.¹⁷ Some authors have suggested that associations are due to the fact that users are systematically different than non-users in ways that predict increased risk for mental health conditions.¹⁸

Most of the information regarding health consequences of marijuana use comes from addiction treatment-seeking

Received April 4, 2013

Revised July 26, 2013

Accepted August 14, 2013

Published online September 19, 2013

populations with a high prevalence of tobacco, alcohol and other drug use, so it is difficult to attribute all of the adverse health effects to marijuana. Marijuana is often used by those who drink excessively and use other drugs,¹⁹ and its effects in those circumstances are also of interest. The impact of current marijuana use identified in adults in primary care, among those who do or do not use other drugs, is unknown.

Substance use is frequent in patients that attend emergency departments,^{20,21} and there are mixed results about the impact that substance use has on hospitalizations.^{22–25} However, among the studies that analyze healthcare utilization among patients with substance use,^{22,23,26–30} marijuana users have been underrepresented.

One U.S. federal program encourages screening for drug use, including marijuana.³¹ If screening for tobacco, other drug use and risky drinking occurs in general health settings, then it should be followed by brief intervention for those who report use.³¹ Brief intervention involves feedback and discussion of negative consequences that may motivate reduced use.³² When more than one substance is used, perceptions of the hazards of use influence which substance is addressed. Moreover, when marijuana use is identified among patients using other drugs, questions arise regarding how to address it.¹⁹ Understanding the effects of marijuana use on health and healthcare utilization is important both for prioritizing which drug to address and for providing content for clinicians to use in discussions with patients when one screens positive for marijuana use. Understanding these effects may also impact health policy decisions.

In this study, we assessed the cross-sectional association between frequency of marijuana use and health care utilization and health among primary care patients identified by screening as using any illicit drugs.

METHODS

Design

This is a cross-sectional analysis examining the association between frequency of marijuana use and emergency department or hospital utilization, any comorbidity and self-reported health status.

Participants

Patients visiting an urban safety-net hospital's primary care clinic in Boston (USA) were universally screened using the following question from the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) that assesses frequency of use in the past 3 months for each drug listed below: "In the past 3 months, how often have you used narcotic pain medications*, sedatives*, amphetamines*, marijuana, cocaine, heroin, hallucinogens, inhalants?"

(*Without a doctor's prescription or in amounts greater than prescribed). Response options for ASSIST questions include: never, once or twice, monthly, weekly, and daily or almost daily. Because the ASSIST asks about "marijuana" and not "cannabis," we use the term "marijuana" throughout this paper.

Patients with any response other than never for any drug were then screened for entry into a randomized trial of brief intervention (NCT00876941, see www.clinicaltrials.gov). The present study is a secondary analysis of subjects enrolled between May 2009 and November 2011. Eligibility criteria for the trial, and therefore this analysis, were as follows: any recent (past 3-month) drug use (marijuana, opioids, cocaine, other drugs); age ≥ 18 years; ability to speak English; willingness to return for study visits in 6 months and ability to provide complete information for two contacts who would know the participant's whereabouts to enable follow-up (these latter criteria were applied because these participants were enrolled in the clinical trial). Participants who were pregnant were excluded. The Institutional Review Board of Boston Medical Center approved this study. All participants provided written informed consent. Of note, at the time of the study, no regulations allowed medical marijuana where the study was done.

Measures

Main Independent Variable. Frequency of recent marijuana use in the past 3 months (assessed using the ASSIST) was the main independent variable. It was defined as a three-level variable: daily use (including "daily or almost daily"); less than daily use; no use. We conducted secondary analyses with marijuana use defined as "any" versus "no use". Additionally, subgroup analyses were conducted among those reporting exclusive marijuana use (marijuana use and no other drug use except alcohol) to compare those with exclusive marijuana use that was daily to those with exclusive marijuana use that was less than daily.

Dependent Variables. Healthcare Utilization. Past 3-month emergency department use or hospital admission were collected by self-report using Form AIR-ED from the COMBINE study³³ at the baseline assessment.

Comorbidity. We assessed comorbidity with the Charlson comorbidity index³⁴ (Deyo modification)³⁵ using ICD-9 (International Classification of Diseases, ninth edition) codes obtained from the outpatient electronic medical record. The outcome of interest for our analyses was any comorbidity, defined as a Charlson index ≥ 1 .

Self-Reported Health Status. By interview, we determined health status with the EuroQol [index from 0 (worst) to 100 (best possible health)].³⁶

Covariates. Potential confounders controlled for in the analyses were age, sex, and any recent (past 3 months) other type of substance use [separate indicators for heavy episodic drinking (≥ 5 drinks for men and ≥ 4 drinks for women on any one occasion); cocaine use; opioid use (prescription opioids or heroin) and any other drug use (sedatives, amphetamines, hallucinogens and inhalants)]; as well as any tobacco use (past year). Cocaine use, opioid use and any other drug use were categorized as any versus none. We did not adjust for other potential predictors of poor health or healthcare utilization that might be in the causal pathway and would therefore obscure the association between marijuana use and the outcomes of interest.

Analysis. Descriptive statistics were used to characterize the study sample. Separate multivariable logistic regression models adjusting for all covariates were used to assess the association between frequency of recent marijuana use (a three-level variable: daily use; less than daily use; no use) and the three dichotomous outcomes of interest: emergency department use, hospitalization and any comorbidity. Multiple linear regression models were fit for the EuroQol outcome. All analyses were performed on data collected during the baseline visit.

Secondary regression analyses were performed evaluating any versus no recent marijuana use and within the subgroup of participants with exclusive marijuana use, comparing daily marijuana use to those with less than daily marijuana use (reference group). For the exclusive marijuana analysis, results were only adjusted for age, gender and heavy episodic drinking in the past 3 months. Adjusted odds ratios (AORs) and 95 % confidence intervals (CIs) were generated from the logistic regression models. Adjusted means and 95 % confidence intervals are reported by group for the linear regression models.

All analyses were conducted using two-sided tests and a significance level of 0.05. Due to the exploratory nature of the analyses, no adjustments were made for multiple comparisons. However, to reduce multiple testing, for the main independent variable, pairwise comparisons were not made unless the global p value for frequency of marijuana use was statistically significant. All statistical analyses were conducted using SAS version 9.2 (SAS Institute Inc., Cary, NC, USA).

RESULTS

Of 1,287 patients with an affirmative response to an ASSIST question for recent drug use, 270 were ineligible and 428 refused to participate in the study; thus, the sample for the current analysis included 589 participants. The main reason for being ineligible was “unwilling/ unable to return for visits” in 209 patients. There were no significant differences in the distribution of gender, age, and frequency

of marijuana use between those eligible individuals who participated in the study ($n=589$) and those eligible individuals who refused to participate ($n=428$) (data not shown).

Table 1 shows key characteristics of the study population, overall as well as stratified by frequency of marijuana use (daily, less than daily use and no marijuana use). In summary, 68 % were male and the mean age was 41 years. All participants reported recent drug use (consistent with eligibility criteria): marijuana 84 % (29 % daily, 55 % less than daily), cocaine use 25 %, opioid use 23 %, other drug use 8 %; 58 % reported use of marijuana only, 7 % cocaine use only and 4 % reported opioid use only. Forty-four percent of the study population reported any recent heavy episodic drinking. A total of 442 participants (75 %) reported any tobacco use in the past year.

A total of 340 participants (69 % of all marijuana users) reported exclusive marijuana use and 129 reported exclusive *daily* marijuana use. Of the 211 participants with less than daily exclusive marijuana use, 97 reported weekly use, 59 reported monthly use and 55 reported having used marijuana once or twice during the past 3 months.

Table 1 also describes the outcomes of interest: 36 % had recent emergency department use, 14 % had a recent hospitalization, and 37 % had any comorbidity (Charlson ≥ 1). The mean EuroQol score was 70.

In unadjusted comparisons, participants with no marijuana use were older, had higher values of AUDIT-C score and had higher rates of opioid use, cocaine use or other drugs when compared to patients with either daily or less than daily recent marijuana use. However, there were no significant differences between groups (daily, less than daily and no marijuana use) with respect to heavy episodic drinking, tobacco use or the presence of 3 of the 4 outcomes of interest (recent emergency department utilization or recent hospitalization and any comorbidity).

In analyses adjusted for age, sex and use of any other drugs, frequency of recent marijuana use was not significantly associated with emergency department [AOR 0.67 (95 % CI 0.36, 1.24) for daily vs. none; AOR 0.69 (95 % CI 0.40, 1.18) for less than daily vs. none], hospitalization [AOR 0.79 (95 % CI 0.35, 1.81) for daily vs. none; AOR 1.23 (95 % CI 0.63, 2.40) for less than daily vs. none], or presence of a comorbidity [AOR 0.62 (95 % CI 0.33, 1.18) for daily vs. none; AOR 0.67 (95 % CI 0.38, 1.17) for less than daily vs. none] (Table 2).

Daily marijuana and less than daily users appeared to have a higher EuroQol value (better health) than those with no marijuana use in the unadjusted analysis (72.4, 70.2 and 66.4, respectively, $p=0.07$), but the difference was attenuated and not statistically significant in adjusted analyses (adjusted mean EuroQol 69.1, 67.8 and 68 for daily, less than daily and none, respectively, $p=0.78$) (Table 3). Secondary analyses of marijuana use defined in two categories (any versus no use) yielded similar results.

Table 1. Baseline Characteristics of the Study Participants and Outcomes of Interest

	Total (n=589)	Daily marijuana use (n=169)	Less than daily marijuana use (n=324)	No marijuana use (n=96)	p value
Age [mean ± SD]	41±12.4	38±13	42±12	44±10	< 0.01
Gender, male [n (%)]	402 (68)	113 (67)	223 (69)	66 (69)	0.90
AUDIT C- score [mean ± SD]	6.1±4.3	4.4±3.7	5.3±3.7	6.1±4.3	< 0.01
Heavy episodic drinking [n (%)]	284 (48)	73 (43)	164 (51)	47 (49)	0.29
Tobacco use (past year) [n (%)]	442 (75)	126 (74.6)	236 (72.8)	80 (83.3)	0.11
Drug use (past 3 months) [n (%)]					
Marijuana [n (%)]:	493 (84)				
• Daily use [n (%)]	169 (29)				
• Less than daily use [n (%)]	324 (55)				
Opioids [Heroin/ prescription opioids] [n (%)]	136 (23)	23 (13.6)	63 (19.4)	50 (52.1)	<0.01
Cocaine [n (%)]	148 (25)	12 (7.1)	72 (22.2)	64 (66.7)	<0.01
Other drugs [Sedatives/ Amphetamines/ Hallucinogens/ Inhalants] [n (%)]	48 (8.1)	16 (9.5)	19 (5.9)	13 (13.5)	0.04
Exclusive marijuana use* [n (%)]	340 (58)	129 (76)	211 (65)		
Outcomes of interest:					
Emergency department utilization (past 3 months) [n (%)]	215 (36)	63 (37.3)	112 (34.6)	40 (41.7)	0.43
Hospital admission (past 3 months) [n (%)]	84 (14)	17 (10.1)	50 (15.4)	17 (17.7)	0.15
EuroQol [mea ± SD]	70±20	72.4±18.6	70.2±20.3	66.4±21.7	0.06
Median (IQR)	73 (55– 85)	75 (60–85)	75 (50–86)	70 (50– 80)	
Charlson comorbidity index (n=580)		(n=165)	(n=320)	(n=95)	
• [median (IQR)]	0 (0–1)	0 (0–1)	0 (0–1)	0 (0–1)	0.57
• Values ≥ 1 [n (%)]	216 (37.2)	57 (34.5)	120 (37.5)	39 (41.1)	

SD Standard deviation; AUDIT-C Alcohol Use Disorders Identification Test-Consumption items; Heavy episodic drinking ≥ 5 drinks for men and ≥ 4 drinks for women on one occasion; IQR Interquartile range; Exclusive marijuana use exclusive marijuana use but no other drug use except alcohol

Among those with exclusive marijuana use (n=340), there was a large degree of variation in the frequency of use among exclusive marijuana users, from 129 (38 %) who reported exclusive daily marijuana use to 55 (16 %) who reported exclusive marijuana use only once or twice during the past 3 months. In these subgroup analyses, we did not detect an association between exclusive daily marijuana use and health services utilization or health (Tables 2 and 3).

DISCUSSION

Among adults in primary care who reported any recent illicit or non-medical prescription drug use, we were unable to detect an association between frequency of marijuana use and emergency department or hospital utilization, any comorbidity and self-reported health status. These results suggest that the frequency of marijuana use among patients who screen positive for drugs in primary care may not be associated with identifiable negative health outcomes as assessed by global measures of health utilization, any comorbidity and health status.

A vast majority of the study participants reported marijuana use, and more than half of the study population reported exclusive marijuana use. It was notable that even though participants were mostly young adults and did not have significant medical comorbidity (the median Charlson index was 0), 14 % had a hospital admission during the prior 3 months and 36 % had visited an emergency department. The

mean EuroQol in our study participants was 70, which is lower than what has been reported in a Canadian study of young adults, where the mean EuroQol value for participants in the same age range was in the low eighties.³⁷ However, it is possible that marijuana use could be more detrimental to the health of the older patients in this study, because of its effects on heart rate and blood pressure.^{10,38}

A variety of approaches were used to represent the main independent variable, frequency of marijuana use (i.e., trichotomous, dichotomous, and exclusive marijuana use). These variations were used to try and capture different aspects of marijuana use that may be associated with the outcomes of interest. None of these analyses found a significant association between marijuana use and participants' health service utilization or health status. To further isolate the effect of marijuana use, we also performed a subgroup analysis in those with exclusive marijuana use. There was a wide range of use among those with exclusive marijuana use, and in comparison to less than daily marijuana use, exclusive daily marijuana use was not significantly associated with health services utilization or health status.

To our knowledge, medical consequences of marijuana use have seldom been explored in adult patients in primary care. The majority of studies have been in addiction treatment populations across the spectrum of drugs. For example, among substance use patients admitted to detoxification, 19 % reported emergency department utilization and 24 % reported hospital admission in the prior 6 months.²⁸ Cohort studies of crack-cocaine smokers,²⁷ methamphetamine injectors,³⁰ other injection drug users,²² and HIV- infected patients with alcohol problems^{23,26} have reported lower rates of emergency depart-

Table 2. Marijuana Use and Emergency Department Utilization, Hospital Admission and Medical Comorbidity (n=589)

Independent variable	Unadjusted analysis OR (95 % CI)	Adjusted [#] analysis AOR (95 % CI)
Emergency department utilization (past 3 months)		
Marijuana use		
Daily (n=169)	0.83 (0.50, 1.39)	0.67 (0.36, 1.24)
Less than daily (n=324)	0.74 (0.46, 1.18)	0.69 (0.40, 1.18)
No use (n=96)	1	1
Marijuana use		
Any (n=493)	0.77 (0.49, 1.20)	0.69 (0.40, 1.16)
No use (n=96)	1	1
Exclusive* marijuana use (n=340):		
Daily (n=129)	1.05 (0.66, 1.66)	0.89 (0.55, 1.43)
Less than daily (n=211)	1	1
Hospital admission (past 3 months)		
Marijuana use		
Daily	0.52 (0.25, 1.07)	0.79 (0.35, 1.81)
Less than daily	0.85 (0.46, 1.55)	1.23 (0.63, 2.40)
No use (n=91)	1	1
Marijuana use		
Any (n=463)	0.73 (0.41, 1.31)	1.13 (0.58, 2.18)
No use (n=91)	1	1
Exclusive* marijuana use (n=340):		
Daily (n=129)	0.62 (0.30, 1.26)	0.60 (0.29, 1.22)
Less than daily (n=211)	1	1
Charlson index ≥ 1		
Marijuana use		
Daily (n=169)	0.76 (0.45, 1.27)	0.62 (0.33, 1.18)
Less than daily (n=324)	0.86 (0.54, 1.37)	0.67 (0.38, 1.17)
No use (n=96)	1	1
Marijuana use		
Any (n=463)	0.83 (0.53, 1.29)	0.66 (0.38, 1.14)
No use (n=91)	1	1
Exclusive* marijuana use:		
Daily (n=129)	0.75 (0.45, 1.20)	0.86 (0.53, 1.38)
Less than daily (n=211)	1	1

*Exclusive marijuana use: exclusive marijuana use but no other drug use except alcohol

[#]Adjusted for age, sex, and any recent (past 3 months) other type of substance use, and any tobacco use (last year)

Table 3. Marijuana Use and Self-Reported Health Status (EuroQol) (n=589)

	EuroQol	
	Unadjusted mean (95 % CI)	p value
Marijuana use		
• Daily (n=169)	72.4 (69.3, 75.4)	0.07 [†]
• Less than daily (n=324)	70.2 (68.0, 72.4)	
• No use (n=96)	66.4 (62.4, 70.4)	
Marijuana use		
• Any (n=463)	70.9 (69.2, 72.7)	0.04
• No use (n=96)	66.3 (62.4, 70.4)	
Exclusive* marijuana use (n=340):		
• Daily (n=129)	72.7 (69.5, 76.0)	0.72
• Less than daily (n=211)	73.5 (70.9, 76.1)	
		Adjusted [#] mean (95 % CI)
		p value
Marijuana use		
• Daily (n=169)	69.1 (64.6, 73.6)	0.78 [†]
• Less than daily (n=324)	67.8 (64.0, 71.6)	
• No use (n=96)	68.0 (63.2, 72.7)	
Marijuana use		
• Any (n=463)	68.0 (63.3, 72.8)	0.97
• No use (n=96)	68.1 (64.5, 71.8)	
Exclusive* marijuana use (n=340):		
• Daily (n=129)	73.4 (69.9, 76.9)	0.58
• Less than daily (n=211)	74.5 (71.8, 77.3)	

Results from each row reflect a different statistical model

*Exclusive marijuana use: exclusive marijuana use but no other drug use except alcohol

[#]Adjusted for age, sex, and any recent (past 3 months) other type of substance use, and tobacco use (past year)

[†]Represents global p value, pairwise comparison reported only if global p value significant at $\alpha=0.05$

ment visits and hospitalizations than our study. However, other studies highlight the high prevalence of substance use in those who attend emergency departments,^{20,21} and the association between substance use and hospital admission.²⁴ The rates of emergency department use were high in our study (36 %), even though one might expect that patients in primary care would be healthier than those admitted to detoxification. Also, in a population-based national survey both the rate of hospital admission in the prior year (6.3 % for men and 8.4 % for women), and the rate of emergency department utilization (18.1 % for men and 20.3 % for women)²⁹ were lower than the rates observed in our study. We did not detect that the frequency of marijuana use further increased emergency department visits or hospitalizations. One explanation for the lack of association between marijuana use and healthcare utilization is that it has little additive impact above use of other drugs; however, that explanation would not apply to those in our sample who used only marijuana and for whom frequency of use was not associated with healthcare utilization.

There is conflicting evidence regarding marijuana use and its health effects. Some authors postulate that marijuana and other cannabinoids could have a medical use, given their beneficial effects on pain control and appetite,³⁹ but there is mounting evidence that marijuana use, even for medical purposes, is associated with some, if not extensive, adverse health consequences.⁴⁰

It is common for users of illicit drugs to use both marijuana and another drug; therefore, knowing the incremental effects of marijuana on health in that circumstance is important. We found that marijuana use was not associated with health status or healthcare utilization in individuals who screen positive for drug use.

This study has several limitations. First, two of the main outcomes (hospital admission and emergency department utilization) are self reported and may be subject to inaccuracy, though it seems unlikely there would be reporting bias associated with marijuana use. Second, even though the Charlson index has been widely used to assess comorbidity, it was initially designed for older adult inpatients to predict mortality, and might not fully capture some medical consequences of substance use. Third, all patients included in the present study reported some recent illicit drug use. Thus, the only non-marijuana using participants in this sample are individuals who are using other illicit drugs. As a result, we focused our main analyses on frequency of marijuana use. Future work should include patients who do not use any other drugs to better identify risks of using marijuana (of note, two-thirds of marijuana users in our sample used no other drugs). Nevertheless, our study includes findings about how the level of marijuana use (from daily to very infrequently) influenced health outcomes among patients who used marijuana and no other drugs. Fourth, we captured recent marijuana use and did not capture prior marijuana use, so some of those who were not current users could have used marijuana in the past. Lastly,

this study may have been underpowered to detect a significant effect of recent marijuana use. To illustrate power and assess the limits of this study, a post-hoc power calculation was performed for emergency department utilization, one of the key outcomes of interest. Assuming 41 % of participants without recent marijuana use report recent emergency department use (as observed in these data), our study has approximately 80 % power to detect an odds ratio as small as 2.1 (or 0.45 if there is a protective effect) for daily marijuana use versus no use and 2.0 (or 0.49 if there is a protective effect) for less than daily marijuana use versus no use.

All in all, our results must be interpreted with caution and do not suggest marijuana use is harmless, particularly since there was not a comparison group with no drug use. However, in this study—among people who reported illicit or non-medical prescription drug use (including marijuana, cocaine, opioids or other drugs), frequency of marijuana use was not significantly associated with health services utilization or health status. Of particular note is the absence of a significant association for patients with frequent use (in comparison to infrequent use) among exclusive marijuana users, a finding that suggests speculation that cutting down use may have little measurable effect on health status or utilization. Future studies should assess the longitudinal impact of marijuana use and should include patients who do not use other drugs.

Acknowledgements: This study was supported by funding from Award Number R01DA025068 from the National Institute on Drug Abuse and, in part, by the National Center for Research Resources (Award Number UL1RR025771).

Dr. Fuster is a postdoctoral grantee from the Spanish Ministry of Education/ Fundación Española para la Ciencia y la Tecnología (EDU/3495/2010). Dr. Fuster was also funded by grants from Ministry of Science and Innovation, Spain (grants RD06/001/0021, RD06/006/1014 and RD12/0028/0006) and Ministry of Health (grant EC11-042).

Conflicts of Interest: The authors declare that they have no conflicts of interest.

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