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## Nonreporting of cannabis use: Predictors and relationship to treatment outcome in methadone maintained patients

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### Abstract

Underreporting of drug use is common and influenced by multiple factors. Cannabis (THC) use nonreporting and its relationship to heroin and cocaine use were investigated in 690 patients enrolled in 25- to 29-week clinical trials of contingency management plus methadone maintenance. Urine specimens and self-reports of drug use were collected 3 times/week. Potential predictors of THC use nonreporting were analyzed by multiple logistic regression; relationships between THC use nonreporting and % cocaine- and opiate-positive urines were analyzed by multiple regression. Compared to non-THC users ( $n=317$ ), patients with THC-positive urines ( $n=373$ ) were more likely to be male and have more years of THC use, but were not different on other characteristics. Nonreporting to user ratios were: THC 191/373 (51.2%); opiates 17/686 (2.5%); cocaine 21/681 (3.1%). Predictors of THC use nonreporting were low rate of THC-positive urines during treatment, fewer days of THC use in the last 30 before treatment, African-American race, and absence of antisocial personality disorder. Nonreporting of THC use was associated with significantly greater opiate and cocaine use. Contingency management decreased cocaine use in THC nonreporters to the level of reporters. Nonreporting of THC use is a significant predictor of greater cocaine and heroin use. This association can be eliminated with contingency management therapy.

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### 1. Introduction

A principal measure in clinical outcome assessment of substance abuse treatment is self-reported retrospective information regarding drug use. However, there is a growing literature suggesting that

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concordance between urinalysis results and self-reported drug use depends on the characteristics of the drug taken (Digiusto, Seres, Bibby, & Batey, 1996; Fishbain, Cutler, Rosomoff, & Rosomoff, 1999; Little, Uhl, Labbe, Abkowitz, & Phillips, 1986). This literature led us in the present study to investigate nonreporting of drug use in individuals receiving methadone maintenance and in whom nonreporting has no formal negative consequences. Preliminary analyses showed that among opiates, cocaine and cannabis, the rate of cannabis nonreporting was highest. Therefore, we sought to identify the predictors most associated with nonreporting of cannabis use.

Our treatment research program has previously shown that cocaine use early in treatment provides a reliable predictor of treatment outcome in contingency-management treatment with methadone maintenance patients (Preston et al., 1998). Recent studies have found that unlike cocaine use, cannabis use per se is not associated with treatment outcome in methadone maintenance outpatients (see Epstein & Preston, 2003 for review). However, the relationship between cannabis use nondisclosure and treatment outcome has not been evaluated. Identifying reliable predictors of treatment outcome is an important aim in clinical research studies. Such predictors should be taken into account when designing well-balanced randomized clinical trials in order to properly stratify variables which may affect outcome. Therefore, we also examined the relationship between cannabis nonreporting and treatment outcome in methadone maintenance in order to evaluate whether it is a reliable predictor of poorer treatment outcome.

In the present study the urine screen results, self-reports of drug use, and demographic, drug history and socioeconomic data from 690 methadone maintenance outpatients participating in one of three clinical trials were used to investigate nonreporting of cannabis use. The data were analyzed to answer the following questions: (1) who are the cannabis nonreporters and what best distinguishes them; (2) can nonreporting be attributed to numbers of positives or to false positives; (3) is nonreporting of cannabis use differentially associated with rates of cocaine or opiate use; (4) what is the relationship between nonreporting of cannabis use and treatment outcome?

## 2. Methods

### 2.1. Participants

The participants were 690 methadone-maintenance outpatients recruited for 25-week randomized controlled clinical trials of a behavioral treatment for opiate abuse ( $n=249$ ) or cocaine abuse ( $n=148$ ) or for a 29-week randomized controlled clinical trial of behavioral and cognitive treatments for cocaine abuse ( $n=293$ ) conducted in the outpatient research clinic of the National Institute on Drug Abuse Intramural Research Program (Epstein, Hawkins, Covi, Umbricht, & Preston, 2003; Preston, Umbricht, & Epstein, 2000; Preston, Umbricht, Wong, & Epstein, 2001). All three studies followed a similar timeline of a five-week period of standard methadone maintenance (baseline phase). At the end of this period, participants were randomized to an experimental behavioral contingency management or control treatment (intervention phase) that lasted eight or 12 weeks, followed by an eight- or twelve-week return to standard treatment (maintenance phase). The primary active behavioral treatment intervention consisted of a voucher-based reinforcement contingency, wherein participants received a voucher for each drug-free urine specimen (negative for metabolites of cocaine or opiates, depending on the study); the vouchers had monetary values that increased with the number of consecutive drug-free urines. Use of other drugs, including cannabinoids, had no effect on voucher delivery. The control intervention consisted of delivery of an equivalent amount of vouchers independent of urine test results. In all three studies,

participants were given no explicit instructions regarding cannabis use. The vouchers in both the experimental and control interventions could be exchanged for goods and services that were consistent with a drug-free lifestyle and patients' treatment goals. Standard therapy included individual counseling and oral methadone at doses ranging from 50–100 mg per day. Additional study details are available in the original study reports (Epstein et al., 2003; Preston et al., 2000, 2001).

During the screening process, all study applicants were interviewed to evaluate current opiate dependence using the DIS-III-R or DIS-IV (Diagnostic Interview Schedule for the DSM-III-R or DSM-IV) and the Addiction Severity Index (ASI) (McLellan et al., 1985). The Shipley Institute of Living scale (Zachary, 1986) and Symptom Checklist-90-Revised (SCL-90-R) (Derogatis, 1977) were administered as questionnaires. Additional inclusion criteria were evidence of cocaine or heroin use, by urine screen. The main exclusion criteria were: current severe psychiatric symptoms or need for psychiatric treatment (either psychotherapy or psychotropic medication), based on a clinical interview by a master's-level drug abuse counselor and the DIS; current need for medical treatment or active medical disorder; breast-feeding or pregnancy. The reliability and validity of DIS diagnoses have been shown to be good for most disorders among drug abusers (Dascalu, Compton, Horton, & Cottler, 2001). The studies were approved by the appropriate Institutional Review Boards. In all cases, after a complete description of the study to the participant, written informed consent was obtained. Treatment was provided free of charge.

## 2.2. Classification of participants

For the analyses reported here, participants were classified as cannabis, cocaine and (or) opiate users if they had at least 1 THC-, cocaine- or opiate-positive urine during treatment. Users of each drug were further classified as either reporters for that drug if they disclosed using the drug on even one occasion, or as nonreporters if not. The dichotomous reporter/nonreporter measure of self-reporting drug use minimized the likelihood that the differential urine detection times following cocaine, opiate, and cannabis use influenced assessment of reliability of drug use disclosure. Because the dichotomous measure might have biased the analyses by masking the impact of number of positives specimens, we additionally conducted separate analyses using the percentage of self-reported drug use (number of self-reports divided by the number of drug-positive urine specimens multiplied by 100) to evaluate whether a quantitative measure would show similar relationships to our outcome measures. This analysis using this quantitative measure takes into account the time dependence of the self-reports of drug use and urine measures.

## 2.3. Measures of drug use

Urine specimens were collected 3 days a week (usually Mondays, Wednesdays, and Fridays), and were analyzed with an enzyme multiplied immunoassay technique (EMIT). The cutoff concentration for cannabinoids was 50 ng/mL; the cutoff concentration for cocaine (measured as benzoylecgonine equivalents, BZE) was 300 ng/mL; the cutoff for opiates (measured as morphine) was 300 ng/mL. After each urine specimen collection, a self-report of drug use interview was conducted in which the participant was asked about drug use since the previous collection, using a checklist of eight drugs/drug classes. Participants were informed that disclosure of drug use had no formal consequences. They were given no explicit instructions regarding cannabis use; they were also not informed of the urine test results. This was consistent across the three studies.

To qualify for the studies, subjects had to participate for at least 5 weeks. For purposes of statistical analyses, only matched pairs of urine specimens and self-reported drug use data were included. This approach excluded only a marginal amount (5.4%) of self-reported drug use data that corresponded to days with missing urine specimens. Self-reported drug use collected for days on which urine specimens were missed were excluded from analyses.

#### 2.4. Statistical analyses

Initial analyses revealed that cannabis use nonreporting, our primary measure of interest, remained nearly constant across each of the clinical trials regardless of the type of behavioral intervention given. Therefore, data from the 690 patients participating in the 3 trials were pooled to provide adequate power for analyses of multiple predictors of nonreporting and their relationships to drug use. A multiple logistic regression analysis ( $\alpha=0.05$ ) was conducted to analyze 18 potential predictors of nonreporting of cannabis use: age; sex; race; education; employment status; total income; illegal income; number of prior drug treatments; years of cannabis use; years of cocaine use; years of heroin use; days of cannabis use, heroin use, or cocaine use in the past month; antisocial personality disorder; cocaine dependence; heroin dependence; and Shipley estimated IQ. Multiple regression analyses ( $\alpha=0.05$ ) were conducted to determine the relationship between cannabis use nonreporting and percentage of cocaine positive urines and percentage of opiate positive urines during the first 5 weeks of treatment (i.e., before initiation of experimental interventions). To evaluate the effect of cannabis use nonreporting on response to contingency management, a multiple regression analysis ( $\alpha=0.05$ ) was conducted to assess the relationship between cannabis use nonreporting and the percentage of cocaine positive urines in patients receiving contingency management treatment for cocaine dependence and participants in the noncontingent control group. Further details of the analyses are provided below in conjunction with the results. Significance is accepted at  $p \leq 0.05$ .

### 3. Results

Among the 690 participants, mean age was  $38.4 \pm 0.27$  (mean  $\pm$  SEM), with a range of 19 to 57 years; 61% were African-American, and 56% were male. The total number of urine specimens collected was 42,639;  $62 \pm 17$  (mean  $\pm$  SEM; range 16–75) urine specimens were collected from each participant. The numbers of individuals who used drugs during treatment (i.e., had at least one urine testing positive) were 373 for cannabis, 686 for opiates, and 681 for cocaine. The total numbers of positive urine specimens were 7129 ( $10.3 \pm 18.7$ /participant) for cannabis, 22,936 ( $33.2 \pm 20.8$ /participant) for opioids and 28,535 ( $41.4 \pm 22.6$ /participant) for cocaine. The total number of self-reported uses was 1470 ( $2.1 \pm 7.0$ /participant) for cannabis, 12,910 ( $18.7 \pm 16.2$ /participant) for opioids and 15,963 ( $23.1 \pm 17.7$ /participant) for cocaine.

Two tailed  $t$  tests ( $\alpha=0.05$ ) revealed that patients with THC-positive urines ( $n=373$ ) did not differ from others ( $n=317$ ) on age, race, education, Shipley estimated IQ, income, treatment retention, or use of heroin or cocaine. However, patients with THC-positive urines were more likely than patients with no THC-positive urines to be male and to have a longer history (years) of cannabis use (Table 1). There were too few nonusers to conduct similar analyses for opiate and cocaine.

Reporting of cannabis use was less consistent with urinalysis results than reporting of heroin or cocaine use: 191/373 (51.2%) never self-reported cannabis use while only 17/686 (2.5%) of the opiate users and 21/681 (3.1%) of the cocaine users were nonreporters. The percentage of non-matching reporting of

Table 1  
Demographic characteristics of users and nonusers of cannabis

	users (N= 373)		nonusers (n=317)		p-value*
	n	%	n	%	
Male	223	59.8	160	50.5	<i>p</i> =0.01*
Race					<i>p</i> =0.34
African-American	222	59.5	200	63.1	
White	147	39.4	117	36.9	
Employment					<i>p</i> =0.44
Unemployed	126	33.8	100	31.5	
Full-time	124	33.2	85	26.8	
Part-time	41	11.0	41	12.9	
Disability	3	0.8	4	1.3	
Other	79	21.2	87	27.5	
Primary drug of abuse					<i>p</i> =0.98
Heroin	156	41.9	133	42.1	
Polydrug	211	56.7	177	56.0	
Other	6	1.4	7	1.9	
		Mean (SD)		Mean (SD)	<i>p</i> -value*
Years of age		38.2 (7.0)		38.7 (7.0)	<i>p</i> =0.31
Education		11.4 (1.8)		11.5 (1.9)	<i>p</i> =0.77
Shipley estimated IQ		95.0 (10.0)		94.3 (9.8)	<i>p</i> =0.28
Num. prior drug treatments		3.6 (2.4)		3.3 (2.0)	<i>p</i> =0.45
Years of cannabis use		6.2 (8.4)		2.6 (5.4)	<i>p</i> <0.001*
Years of heroin use		12.9 (8.4)		12.8 (8.3)	<i>p</i> =0.85
Years of cocaine use		8.0 (7.2)		8.0 (7.1)	<i>p</i> =0.96
Total no. of urines given		64.3 (17.4)		65.8 (18.7)	<i>p</i> =0.57
No. of THC-positive urines		19.1 (21.9)		n/a	

\* *p*-value from *t* test.

cannabis use and urine tests was nearly constant across the study: 43% during the first 5 weeks of treatment, 48% during the 8- or 12-week behavioral intervention for cocaine or opiate use, and 46% during the 8- or 12-week postintervention maintenance. Among the participants who reported cannabis use, 42% reported their first positive; 70% had reported by the time they had a second positive, and 81% had reported by the time they had a fourth.

### 3.1. Characteristics of cannabis nonreporters

Multiple logistic regression analysis of 18 demographic, drug use history, and socioeconomic variables revealed four significant predictors of nonreporting: percentage of THC-positive urine specimens, days of cannabis use in the last 30, race, and diagnosis of antisocial personality disorder. Nonreporters of cannabis use were more likely to be infrequent users, as evidenced by a significantly lower percentage of THC-positive urines [adj. OR=0.07; 95% CL 0.03–0.19; Wald  $X^2=29.36$ , *p*<0.0001] and fewer days of cannabis use in the 30 days prior to treatment admission [adj. OR=0.90; 95% CL 0.83–0.99; Wald  $X^2=5.18$ , *p*<0.05] in nonreporters (*N*=191) than in reporters (*N*=182). The relationship between % of

nonreporters and % of THC-positive urine specimens during treatment is shown in Fig. 1 in a smoothed scatterplot, as recommended by Hosmer and Lemeshow (1989). The relationship between low rates of positive specimens and nonreporting did not appear to be an artifact of the rate of positives: a standardized measure of cannabis use nonreporting (ratio of the percentage of self-reported THC use over the percentage of THC-positive urines) was not significantly correlated with frequency of THC use (Pearson's rho coefficient=0.04969,  $p=0.34$ ) (Fig. 2). In re-analyses conducted assuming that anyone with 2 or fewer positive specimens was a nonuser, nonreporting of use was still present (119/373 users; 32%) and showed a significant inverse association with frequency of use.

During treatment, there was no difference in cannabis use between white and African-American participants; mean (SEM) percentage of THC-positive urines was 16.31% (1.4%) for African-American patients and 16.91% (1.7%) for Caucasian patients ( $t$ -value=0.27,  $p$ -value=0.79). Also, there was no significant relationship between race and frequency of self-reported pretreatment cannabis use in the 30 days prior to treatment admission [adj. OR=0.98; 95% CL 0.95–1.02; Wald  $X^2=1.07$ ,  $p>0.05$ ]. However, nonreporters of cannabis use were more likely to be African-American [adj. OR=1.63; CL 1.02–2.60; Wald  $X^2=4.08$ ,  $p<0.05$ ].

Nonreporters were significantly less likely to have antisocial personality disorder [adj. OR=0.32; 95% CL 0.08–0.89; Wald  $X^2=4.63$ ,  $p<0.05$ ]. Rates of THC-positive urine specimens were not significantly different ( $t$ -value=0.61,  $p$ -value=0.54) between participants with and those without antisocial personality disorder: mean (SEM) percentage of THC-positive urines 14.37% (3.6%) and 16.74% (1.1%), respectively.

### 3.2. Cannabis-use nonreporting and cocaine or opioid use during standard treatment

Multiple regression analyses were conducted to evaluate whether nonreporting of cannabis use (or related characteristics such as race, antisocial personality disorder, and frequency of cannabis use in the last 30 days) predicted the percentage of cocaine- and opiate-positive urines during the first 5 weeks of

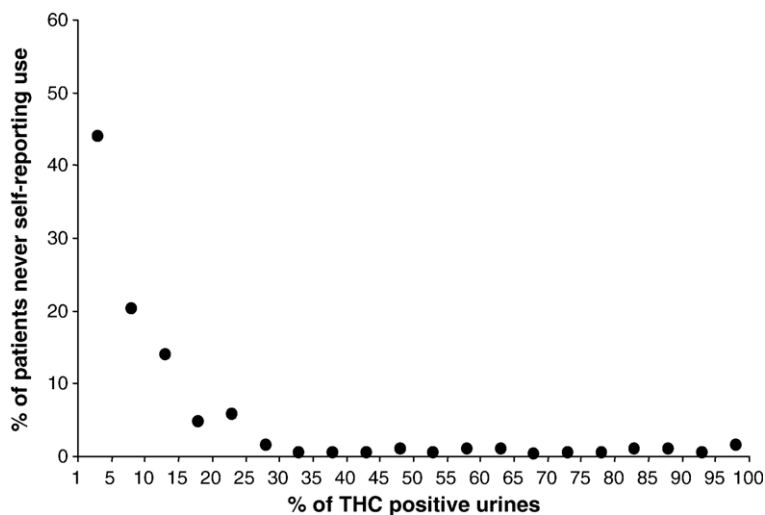


Fig. 1. The horizontal axis of this smoothed scatterplot categorizes patients according to their percentage of THC-positive urines. The vertical axis shows, within each category, the percentage of patients who never self-reported cannabis use.

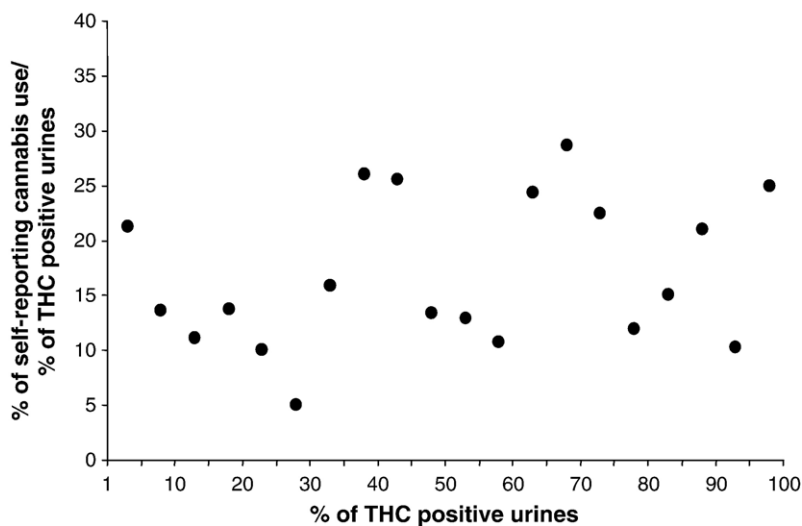


Fig. 2. The horizontal axis of this smoothed scatterplot categorizes patients according to their percentage of THC-positive urines. The vertical axis shows, within each category, a standardized measure of the likelihood of self-reporting THC use: a ratio of the percentage of self-reported THC use over the percentage of THC-positive urines. Frequent THC users were not more likely to report THC use than infrequent users. Similarly, infrequent THC-users were not more likely to fail to report than frequent users.

methadone maintenance therapy. Nonreporters of cannabis use had significantly greater percentage of opiate-positive urines ( $F_{2,238}$  for multiple regression = 3.06,  $p < 0.05$ ) and cocaine-positive urines ( $F_{2,238}$  for multiple regression = 6.64,  $p < 0.01$ ) relative to cannabis reporters (Table 2 shows  $t$  tests and  $p$ -values for the individual factor of cannabis use nonreporting within the overall model). This analysis controlled for other potential mediators. No other variables met significance in the multiple regression analysis. For example, the percentage of THC-positive urines, African-American race, and antisocial personality disorder were not significant predictors of greater percentage of cocaine positive urines ( $t = -1.41$ ,  $p = 0.161$ ;  $t = 1.08$ ,  $p = 0.282$ ;  $t = -0.9$ ,  $p = 0.372$ ; percentage of THC-positive urines, African-American race, and antisocial personality disorder, respectively) or opiate-positive urines ( $t = -0.5$ ,  $p = 0.615$ ;

Table 2  
Cannabis use reporting and cocaine and opiate use

	Nonreporters	Reporters	Statistic
Standard treatment (first 5 weeks)	( $n = 191$ )	( $n = 182$ )	
% Opiate positive	75.3 ± 2.5	65.1 ± 3.2	$t = 2.23$ ; $p = 0.027$
% Cocaine positive	83.6 ± 7.1	75.2 ± 7.4	$t = 1.99$ ; $p < 0.05$
<i>Contingency Management Intervention</i>			
Control group	( $n = 91$ )	( $n = 85$ )	
% Cocaine positive	77.6 ± 3.0	65.7 ± 3.5	$t = 2.50$ ; $p = 0.013$
% Opiate positive	59.2 ± 3.2	49.0 ± 3.7	$t = 2.04$ , $p = 0.043$
Contingent group	( $n = 79$ )	( $n = 40$ )	
% Cocaine positive	66.1 ± 4.3	63.8 ± 6.5	$t = 0.60$ ; $p = 0.56$
% Opiate positive	55.6 ± 4.3	45.6 ± 5.5	$t = 1.58$ , $p = 0.12$

$t=0.54, p=0.593$ ;  $t=-0.49, p=0.626$ ; percentage of THC-positive urines, African-American race, and antisocial personality disorder, respectively). Separate multiple regression analyses conducted using percentage of self-reported cannabis use rather than nonreporting of cannabis use and percentage of cocaine-positive urines and of opiate-positive urines as the outcome measures revealed similar results. The adjusted  $R$ -square for these relationships was 0.1 with percentage of cocaine-positive urines as the outcome measure and was 0.09 with percentage of opiate-positive urines as the outcome measure. It was not possible to investigate the relationship between antisocial personality disorder and cocaine or opiate use nondisclosure because there were too few nonreporters of cocaine or opiate use to conduct such an analysis.

### 3.3. Cannabis-use nonreporting and cocaine use during contingency management

A primary objective in the clinical trials from which these data were derived was to evaluate the efficacy of contingency management for decreasing cocaine or opiate abuse. Nonreporters of cannabis use in the control group had a greater percentage of cocaine-positive [ $F_{3,172}$  for multiple regression=2.87,  $p=.0379$ ] and opiate-positive [ $F_{3,172}$  for multiple regression=3.97,  $p<0.01$ ] urines relative to cannabis reporters in that group (Table 2). No other variables met significance in the multiple regression analysis. In contrast, in contingency-management treatment for cocaine abuse, cannabis nonreporters responded to the contingency management intervention as well as did reporters of cannabis use in terms of cocaine-positive urines [ $F_{3,150}$  for multiple regression=0.32,  $p=0.812$ ] and opiate-positive urines [ $F_{3,150}$  for multiple regression=1.55,  $p=0.204$ ] (Table 2). The small sample size of participants in the opiate contingency management group precluded analysis of the relationship between cannabis use nonreporting and the percentage of opiate-positive urines.

## 4. Discussion

The present study found that in patients in methadone-maintenance therapy for whom there are no negative consequences imposed for reporting or nonreporting, the drug use that goes unmentioned tends to be cannabis rather than opiates or cocaine. Additionally, light rather than heavy cannabis use was especially likely to be nonreported. Non-disclosure of cannabis use was significantly associated with more cocaine and heroin use; thus, important differences in treatment outcome exist between patients who fail to disclose their cannabis use and patients who report their use. This result could have clinically relevant implications for designing well-balanced randomized treatment efficacy studies because it identifies a subgroup of patients, those who do not disclose their cannabis use, that is less sensitive to standard methadone maintenance treatment.

Reporting of cannabis use was substantially less consistent with urinalysis results than reporting of heroin or cocaine use: half (51.2%) of all participants who ever tested positive for cannabis never reported use while less than 5% of the opiate users (2.5%) and (3.1%) of the cocaine users were nonreporters. Nonreporting was particularly common among infrequent cannabis users (Fig. 1). The results of the present study support conclusions from longitudinal studies by Fendrich and Mackesy-Amiti (1995) and Harrison, Haaga, and Richards (1993), who found false self-reporting of drug use to be prevalent among cannabis users. The finding of a significant correlation between failure to disclose cannabis use and infrequent THC use is consistent with the conclusions of Fendrich and Mackesy-Amiti (1995) and Harrison et al. (1993) who also found that lower-level cannabis users (those who use cannabis infrequently) are more likely to fail to report on their drug use. The present result indicating inaccuracies

in the self-reporting of cannabis use among patients in clinical settings is consistent with findings from other studies (Buchan, Dennis, Tims, & Diamond, 2002; Fishbain et al., 1999; Neale & Robertson, 2003). However, this is the first study, to our knowledge, that has demonstrated a relationship between nonreporting of cannabis and responsiveness to treatment for other drugs of abuse.

There was no evidence to suggest that the relationship between low rates of positive specimens and nonreporting was an artifact of the rate of positives or that patients who did not disclose their cannabis use were simply nonusers with false positives. Although it is possible that frequent users disclose cannabis use merely because they have more opportunities to report, a standardized measure of cannabis use nonreporting (ratio of the percentage of self-reported THC use over the percentage of THC-positive urines) was not significantly correlated with frequency of THC use (Fig. 2). Moreover, as mentioned in Results, many reporters (42%) reported their first positive, and most (70%) reported by the time they had a second positive. Even in a reanalysis in which all participants with 2 or fewer positives urine specimens were identified as non-users, 32% of the remaining 119 cannabis users were nonreporters, and the inverse association with rate of THC-positive urine specimens was significant. Multiple false positives are unlikely to account for this high number of multiple unreported uses given that the rate of EMIT false positives for THC is 2.5% to 3.2% (Ferrara et al., 1994; Huestis, Mitchell, & Cone, 1994). Also, it is highly unlikely that many THC positives resulted from (Niedbala et al., 2005).

#### *4.1. Nonreporting of THC use was more common among African-Americans and was less common in patients with antisocial personality disorder*

The present study sought to identify predictors that best distinguish patients who disclose their cannabis use from those who do not. We found race differences in reporting validity of cannabis use. After controlling for other potential mediators by using multiple logistic regression, we found that African-Americans had significantly greater odds of not reporting cannabis use. These results are consistent with a recent report by Fendrich and Johnson (2005) who examined race differences in self-reporting validity of drug use by comparing drug test results to self-reported cannabis use in the past month. They found that African-Americans less reliably reported their cannabis use, as evidenced by a lower concordance between self-reported use and drug test results. This decreased disclosure could reflect a lower level of trust or communication among African-Americans when disclosing sensitive, illegal information to a person of another race (Cooper-Patrick, Gallo, Gonzalez, Vu, Powe, Nelson, & Ford, 1999; Collins et al., 2002; Richardson, Fendrich, & Johnson, 2003). Our findings in this regard are consistent with those of a recent study in which among individuals interviewed by a Hispanic interviewer, African-Americans were only a third as likely as Caucasians to disclose continued cocaine use, while for individuals interviewed by an African-American interviewer, African-Americans and Caucasian patients had similar odds of disclosure (Tassiopoulous et al., 2006). In our study, self-report data were collected by technicians, some of whom were African-American and some of whom were Caucasian; it is not feasible for us to reanalyze our data in terms of which self-reports were collected by which technician. We suspect that it is important, whenever possible, to match the ethnicity of the healthcare provider and the patient, and to be cognizant of sociocultural factors that can lessen accuracy of self-report data in clinical studies.

Participants with antisocial personality disorder were more likely to report their cannabis use. As with all other analyses, we ruled out other potential mediators of this relationship by use of multiple logistic

regression. The direction of the relationship may seem surprising, given that one of the diagnostic criteria for antisocial personality disorder is deceitfulness (American Psychological Association, 1994). However, other criteria for antisocial personality disorder involve indifference toward the feelings of others and disregard for certain types of social norms (American Psychological Association, 1994). These patterns of behavior suggest that when asked to report illicit behaviors, antisocial individuals may be relatively immune to social-desirability effects. We know of no studies of social-desirability effects in antisocial individuals diagnosed by DSM criteria. However, several studies have shown that social-desirability scores correlate inversely with scores on psychopathy checklists (Zágon & Jackson, 1994), and that the correlation is often specific to the behavioral aspects of psychopathy reflected in the DSM diagnostic criteria (Poythress, Edens, & Lilienfeld, 1998; Seto, Khattar, Lalumière, & Quinsey, 1997). The relative indifference to impression management that presumably helped some of our antisocial participants acknowledge undesirable behaviors during DIS interviews may also have enabled them to report more of their cannabis use during treatment. A previous study also showed concordance between self-reported drug use and urinalysis results in methadone maintenance patients with antisocial personality disorder (King, Kidorf, Stoller, Carter, & Brooner, 2001).

#### *4.2. Nonreporting of THC use was associated with poorer treatment outcome for cocaine and opiate dependence, although cannabis use per se does not predict treatment outcome*

Greater cocaine use early in treatment has been shown to be a reliable predictor of poorer outcome in methadone maintenance (Preston et al., 1998). In contrast, cannabis use per se is not related to treatment outcome for cocaine or heroin dependence in patients in methadone-maintenance treatment (Epstein & Preston, 2003). Somewhat surprisingly, the present study shows that nonreporting of THC use is a significant predictor of greater cocaine and heroin use. Multiple regression analyses revealed that predictors of cannabis use nonreporting (race, frequency of cannabis use in the last 30 days, and antisocial personality disorder) did not account for this relationship. These results need replication in future studies.

Cannabis use nonreporting predicts greater cocaine and opiate use in methadone maintained patients not given contingency management treatment, suggesting that the reluctance to mention such use may be a marker for poor treatment response in patients in methadone maintenance therapy. However, the relationship between cannabis-use nonreporting and cocaine use was eliminated when treatment was supplemented with contingency management targeted toward cocaine: the beneficial effects of contingency management apparently overwhelmed the association. Thus, patients who do not disclose their cannabis use may benefit from more intensive treatment than other patients. These data may also have implications for clinical studies evaluating treatment outcome in methadone maintenance patients. The greater opiate and cocaine use among methadone maintained patients who have not disclosed their cannabis use suggests that disclosure of cannabis use should be used as a covariate in analyses of covariance, in order to control for the effects of this variable on treatment outcome.

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