

DRUG COURT PRACTITIONER

F A C T S H E E T

THE MARIJUANA DETECTION WINDOW: DETERMINING THE LENGTH OF TIME CANNABINOIDS WILL REMAIN DETECTABLE IN URINE FOLLOWING SMOKING

A CRITICAL REVIEW OF RELEVANT RESEARCH AND CANNABINOID DETECTION GUIDANCE FOR DRUG COURTS

By Paul L. Cary, M.S.

PREFACE

The duration of the urinary cannabinoid detection window is not settled science. The number of days, following the cessation of marijuana smoking, necessary for cannabinoids to become non-detectable using traditional drug testing methods is the subject of debate among forensic toxicologists and a matter of on-going scientific research. This article makes no pretense to limit this important discussion, but rather, seeks to enhance it. It is hoped that drug court practitioners will find that this information clarifies some of the complex issues associated with the elimination of marijuana from the human body.

Conventional wisdom has led to the common assumption that cannabinoids will remain detectable in urine for 30 days or longer following the use of marijuana. These prolonged cannabinoid elimination projections have likely resulted in the delay of therapeutic intervention, thwarted the timely use of judicial sanctioning, and fostered the denial of marijuana usage by drug court participants.

This review challenges some of the research upon which the 30-plus day elimination assumption is based. Careful scrutiny of these studies should not be interpreted as an effort to discredit the findings or the authors of this research. However, as our knowledge evolves, the relevancy of previously published scientific data should be evaluated anew. One fact is clear—more research is needed in the area cannabinoid elimination.

Merely attempting to formulate cannabinoid detection guidance invites controversy. Some will argue that the proposed detection window defined in this article is too short. Others will suggest the opposite. Still others will insist that the scientific evidence is insufficient to allow the establishment of such guidance. To some degree, each position has merit. No detection window guidance, regardless of the extent of scientific support, will encompass every set of circumstances or all client situations. If nothing else, the research demonstrates that there is significant variability between individuals in the time required to eliminate drugs.

These facts, however, should not preclude the development of reasonable and pragmatic guidance, supported by scientific research, for use in the majority of drug court adjudications. It is widely accepted that in order to instill successful behavioral changes in a substance abusing population, that consequences need to be applied soon after the identification of renewed or continued drug use. In a drug court context, the application of judicial sanctions and the initiation of therapeutic interventions have been needlessly delayed due to a lack of coherent guidance regarding the length of time cannabinoids will likely remain detectable in urine following the cessation of marijuana smoking. The purpose of this article is to provide that much needed guidance.

INTRODUCTION

In a recent forensic publication, Dr. Marilyn Huestis wrote: "Monitoring acute cannabis usage with a commercial cannabinoid immunoassay with a 50-ng/mL cutoff concentration provides only a narrow window of detection of 1–2 days," (2002). In a 1985 article by Ellis et. al., researchers concluded; "that under very strictly supervised abstinence, chronic users can have positive results for cannabinoids in urine at 20 ng/mL or above on the EMIT-d.a.u. assay¹ for as many as 46 consecutive days from admission, and can take as many as 77 days to drop below

the cutoff calibrator for ten consecutive days." Based upon these seemingly divergent findings, it is not difficult to comprehend why judges, attorneys and other drug court professionals are in a quandary regarding the length of time marijuana can remain detectable in urine following use. The dilemma—if the scientific research seems not to be able to achieve consensus on the urinary cannabinoid detection window, how are those responsible for court mandated drug supervision programs suppose to understand and resolve this issue?

Like many other scientific and technical topics that have been thrust into the judicial environment, the detection window of marijuana is both complex and controversial, yet the understanding of the pharmacology of this popular substance is crucial to the adjudication of cases in which marijuana usage is involved. While the difficulties associated with establishing the length of time a drug will continue to test positive in urine after use are not unique to marijuana, the problem is exacerbated by the extended elimination characteristics of cannabinoids relative to other drugs of abuse, most notably after chronic use.

The questions posed by drug court professionals related to cannabinoid detection in urine include:

- *How many days is it likely to take for a chronic marijuana user to reach a negative urine drug test result?*
- *How long can cannabinoids be excreted and detected in urine after a single exposure to marijuana?*
- *How many days of positive urine drug tests for cannabinoids constitutes continued marijuana usage?*
- *How often should a client's urine be tested to monitor for continued abstinence from marijuana?*
- *How many days should the court wait before retesting a client after a positive urine drug test for cannabinoids has been obtained?*
- *How should the court interpret a positive urine drug test for cannabinoids after a client has completed an initial 30-day detoxification period designed to "clean out" their system?*

To one degree or another, answering these questions depends upon the ability of the court to estimate the length of time cannabinoids will likely remain detectable in urine following the use of marijuana by a drug court client. Thus, the cannabinoid detection window becomes a determinative factor in the appropriate interpretation of urine drug testing results for marijuana. The lack of adequate guidance has hindered the development of these standards for use in drug court.

It is important to note that while courts may be seeking absolute answers (an exact cannabinoid detection window), the science of drug detection in urine can only provide reasonable best estimates. The law is not always black and white; neither is science. Therefore, precise “yes/no” answers or exact detection windows are generally not attainable. Sensible guidance for the interpretation of urine cannabinoid results by drug courts, however, is achievable.

FRAMING THE QUESTION

Simply put, the *detection window* is the length of time in days following the last substance usage that sequentially collected urine samples will continue to produce positive drug test results—in other words, the number of days until last positive sample. This time period is *not* the same as the length of time a drug will remain in someone’s system—that concept is, in reality, indeterminable (given that there is no analytical method capable of detecting the presence of a single molecule of drug in a donor’s body). The question being addressed herein is not how long minute traces of marijuana will remain in a client’s tissues or fluids after smoking, but rather how long those residual cannabinoid metabolites will continue to be excreted in urine in sufficient quantities to produce a positive drug test (by standard screening and confirmation testing).

Study subjects with exceptionally long cannabinoid detection times (30-plus days) were just that-exceptional.

For those compounds with uncomplicated metabolic pathways or for those drugs that are not significantly retained in body storage compartments, detection times have been established and generally accepted. These include urinary detection windows for drugs such as cocaine (1-3 days), amphetamines and opiates (1-4 days), and PCP (1-6 days) (Baselt, 2004). For marijuana, the urine elimination profile used to establish the detection window is more complex. It is well documented and understood that cannabinoids are lipid-soluble compounds that preferentially bind to fat-containing structures within the human body (Baselt, 2004). This and other chemical characteristics can prolong the elimination half-life of cannabinoids and extend the detection window beyond that of other abused substances. Chronic marijuana use, which expands body stores of drug metabolites faster than they can be eliminated, further increases cannabinoid detection time in urine.

VARIABLES

Estimating the detection time of a drug in urine is a complex task because of the many factors that influence a compound’s elimination from the body. Additionally, technical aspects of the testing methods themselves also affect how long a drug will continue to be detected in urine. The pharmacological variables affecting the duration of detection include drug dose, route of administration, duration of use (acute or chronic), and rate of metabolism. Detection time is also dependent upon analytical factors including the sensitivity of the test (cutoff concentration) and the method’s specificity (the actual drug and/or metabolite that is being detected).

Generally speaking, the following factors affect the marijuana detection window accordingly:

- **Drug Dose**
The higher the dose; the longer the detection window. The percentage of psychologically active delta-9 THC in marijuana plant material varies considerably, making dosage difficult to estimate.
- **Route of Entry**
Inhalation (smoking) is the only route of administration to be evaluated in this review.
- **Duration/Frequency of Use**
The longer the duration and the greater the frequency of cannabinoid usage (chronic); the greater the body storage of fat-soluble metabolites; the longer the cannabinoid detection window. Drug surveillance programs may be able to define use patterns based on client self-reporting, arrest reports, documentation of previous treatment, or other court records.
- **Metabolism Rate**
The higher the metabolic functions of the client; the faster cannabinoids are broken down; the shorter the detection window. Monitoring programs cannot determine this parameter.
- **Test Sensitivity**
The lower the cutoff concentration; the more sensitivity the testing method toward cannabinoids; the longer the detection window. Court staff can select between various cannabinoid testing cutoffs.
- **Test Specificity**
The less specific the testing method; the greater number of cannabinoid metabolites detected; the longer the detection window. This is difficult for monitoring programs to assess without technical assistance.

Of these variables, drug courts are effectively limited to controlling only the sensitivity of the drug test itself (i.e., cutoff concentration). Initial screening test cutoffs for cannabinoids in urine generally include thresholds at 20, 50, and 100 ng/mL. The choice of testing cutoff has a profound effect on the cannabinoid detection window. The only other factor that can assist the court in the interpretation of cannabinoid testing results and the estimation of a client's detection window is attempting to define the duration and extent of a client's marijuana use over time (acute or chronic).

The differentiation between acute (a single use event or occasional use) versus chronic (persistent, long-term, continued usage) is important to establishing reliable detection benchmarks. As a result, drug court practitioners should attempt to gather as much information as they can about client drug use behavior and patterns.

Finally, the detection window by its very nature is subject to the timing of events outside the purview of the court. The last use of marijuana by a client prior to a positive test is often unknown to drug court staff. Thus, the real interval between drug usage and first detection can rarely be ascertained. For example, if a client smoked marijuana on Monday and a urine sample collected on Friday produced a positive result, the window of detection is 4 days shorter than if that same client had smoked on Thursday and produced a positive cannabinoid test on Friday. Therefore, the actual detection window for marijuana will almost always be longer than the analytically derived detection window as determined via positive tests.

RESEARCH REVIEW

Research associated with the detection window of cannabinoids in urine spans several decades. While these studies have produced a significant amount of valuable information about marijuana elimination, older studies (primarily those performed in the 1980's) have also yielded some unintended consequences as pertains to the detection window. The technologies of drug testing and the methodologies used in drug detection have advanced rapidly in recent years. Consequently, cannabinoid detection studies performed twenty years ago (employing older immunoassays methods) utilized drug testing methods that are either no longer in widespread use or assays that have been extensively reformulated.

As cannabinoid screening tests evolved, these improved assays became more selective in the manner in which they detected marijuana metabolites (breakdown products). As detection

Table 1. Review of Cannabinoid Studies Reporting Long Detection Times

Maximum Detection Times Determined for Cannabinoids	Factors Potentially Affecting the Relevance of Study Findings to Cannabinoid Detection Window Interpretation	Year	Author
36 days	Retrospective case study of a single patient; report on 6 similar cases included; no testing data provided in publication; no cannabinoid cutoff given	1982	Dackis et al.
37 days	27 subjects studied, no testing data provided in publication; cannabinoid cutoff not provided; "calculated" cannabinoid cutoff less than 10 ng/mL; 37 day detection derived from 95% confidence interval for calculated elimination half-life; actual length of positivity averaged 9.7 days (5-20 days); authors acknowledge subjects may have been able to obtain marijuana during study; possibility supported by staff monitoring subjects	1983	Cridland et al.
40 days	10 subjects studied; self-reported as chronic users; subjects housed on unrestricted drug treatment ward; marijuana use during study suspected by authors and confirmed by several subjects	1984	Swatek
67 days	86 subjects studied; self-reported as chronic users; subjects treated on "closely supervised" ward; single case of an individual's time to last positive urine (at or above 20 ng/mL) of 67 days (77 days to drop below the cutoff calibrator for ten consecutive days); spikes in urine cannabinoid levels during the study are not explained by the authors	1985	Ellis et al.
25 days	11 subjects studied for cannabinoid elimination patterns (70 participants in entire study); only one subject remained positive for 25 days; mean elimination for self-reported "heavy" users was 13 days; immunoassay used in study not commercially available since 1995.	1985	Schwartz et al.
25 days	13 subjects studied; self-reported as chronic users; subject abstinence not supervised during study; subjects allowed to smoke marijuana before and on the day of test drug administration; only one subject tested positive beyond 14 days	1989	Johansson & Halldin
25 days	Subject detection times determined using methods with a 5 ng/mL cannabinoid cutoff concentration	1994	Iten
32 days	19 subjects studied - half withdrew from study prior to completion; subjects were prisoners housed in general population with no additional surveillance; participants not asked to report new drug use during study; marijuana use during study suspected by authors	1999	Smith-Kielland et al.

specificity increased, the length of time cannabinoids were being detected in urine decreased. The greater the cannabinoid testing specificity, the shorter the detection window. Studies have demonstrated that detection times of cannabinoid metabolites in urine monitored by immunoassay have decreased over the past two decades (Huestis, 2002; Huestis, Mitchell, & Cone, 1994). Therefore, the results of cannabinoid elimination investigations performed in the 1980's may no longer be applicable to estimating the detection window for marijuana in urine using today's testing methodologies. Not to mention that twenty years ago, the routine use of on-site drug testing devices was nonexistent.

Studies of chronic marijuana users reporting prolonged cannabinoid excretion profiles have provided the basis for the common assumption that marijuana can be detected in urine for weeks or even months following use. In general, cannabinoid elimination studies that have manifested exceptionally long detection times suffer from a variety of research design shortcomings that raise concerns about their usefulness in establishing a reliable cannabinoid detection window for use in the modern drug court movement. Table I examines some of the potentially limiting factors from studies that produced prolonged cannabinoid detection times.

The detection window for cannabinoids in urine must be seen in the proper context—as a reasonable estimate.

The research studies presented in Table 1 contain numerous design details that confound the use of the data presented in establishing a reasonable and pragmatic cannabinoid detection window for drug court proceedings. The most serious of these obfuscating factors is the inability to assure marijuana abstinence of the subjects during the studies. The adverse

effect of this flaw on determining the true cannabinoid elimination time after marijuana cessation is significant. Drug use during an elimination study would extend the duration cannabinoids would be detected in the urine of subjects and would produce inaccurately long detection windows. In several cases, the authors themselves in their own review of results raise this concern. Other study design issues that may limit their usefulness include the use of detection methods with cannabinoid cutoff concentrations far below those traditionally utilized in criminal justice programs, the use of testing methods no longer commercially available and the use of immunoassay drug tests with reduced cannabinoid specificity (as compared with current immunoassay testing methods). It is not the intention of this article to discredit these studies, but rather to illustrate the degree to which their prolonged cannabinoid detection findings have influenced the understanding of the length of time cannabinoids can be detected in urine.

This critical evaluation (Table 1) is not presented to imply that these peer-reviewed articles are unscientific or contain no information of probative value. It is insufficient, however, to merely read the abstract of a scientific paper or the findings of a research study and draw the conclusion that a drug court client can remain positive for 30 days or longer, based upon the longest cannabinoid detection time reported therein. The data from these studies are often misused to make such claims.

Despite the potential limitations affecting the interpretation of the data produced by the studies in Table 1, the research does present some general cannabinoid elimination trends worth further examination. A closer evaluation of the study by Smith-Kielland, Skuterud, & Morland indicates that even with the factors identified as limiting its relevance, the average time to the first negative urine sample at a cannabinoid cutoff of 20 ng/mL was just 3.8 days for infrequent users and only 11.3 days for frequent users (1999). In the Swatek study, eight out of ten chronic subjects tested below the 50 ng/mL cutoff after an average of only

13 days (range 5-19 days) (1984). Johansson and Halldin identified only one study subject that tested positive for longer than 14 days with all thirteen subjects having an average last day with detectable levels (using a 20 ng/mL cutoff) of 9.8 days (1989). In other words, despite the potential factors restricting interpretation, those study subjects with exceptionally long cannabinoid detection times (30-plus days) were just that—exceptional. In several of the studies presented in Table 1, only a single subject was the source of the maximum cannabinoid detection time. Unfortunately, these rare occurrences have had a disproportional influence on the overall cannabinoid detection window discussion in a manner that has led to the general assumption that 30-plus day detection times are routine in drug court clients—regardless of use patterns (chronic vs. acute). Moreover, this prolonged elimination assumption and its widespread use as exculpatory evidence has most likely fostered client denial and hindered legitimate sanctioning efforts.

By contrast, the research associated with acute marijuana usage and resulting cannabinoid detection window is considerably more straightforward and less contentious. In a 1995 study using six healthy males (under continuous medical supervision), Huestis, Mitchell, & Cone determined that the mean detection times following a low dose marijuana cigarette ranged from 1 to 5 days and after a high dose cigarette from 3 to 6 days at a 20 ng/mL immunoassay cutoff concentration (average 2.1 days and 3.8 days, respectively) (1995). They also concluded that immunoassays at the 50 ng/mL cannabinoid cutoff provide only a narrow window of detection of 1-2 days following single-event use. In 1996, Huestis et. al. published research focusing on carboxy-THC, the cannabinoid metabolite most often identified by gas chromatography/mass spectrometry (GC/MS) confirmation methods. Using the 15 ng/mL GC/MS cutoff, the detection time for the last positive urine sample (for six subjects following high dose smoking) was 122 hours—just over five days. In 2001,

Niedbala et. al. demonstrated similar results with 18 healthy male subjects following the smoking of cigarettes containing an average THC content of 20-25 mg. Analyzing urine samples at a 50 ng/mL immunoassay cutoff yielded an average cannabinoid detection time of 42 hours. These acute marijuana elimination studies conclude that after single usage events cannabinoids are detected in urine for no more than a few days.

While studies of the cannabinoid detection window in chronic substance users have been more difficult to accomplish, research protocols have been developed to overcome concerns about marijuana usage during the study. Using a well-crafted study design, Kouri, Pope, & Lukas in 1999 determined the cannabinoid elimination profiles of 17 chronic users. Subjects were selected after reporting a history of at least 5000 separate “episodes” of marijuana use in their lifetime (the equivalent of smoking once per day for 13.7 years) plus continuing daily usage. Abstinence during the 28-day study was ensured by withdrawing those subjects whose normalized urine cannabinoid levels (cannabinoid/creatinine ratio) indicated evidence of new marijuana use. Kouri, et al, found that five of the 17 subjects reached non-detectable levels (less than 20 ng/mL) within the first week of abstinence, four during the second week, two during the third week and the remaining six subjects still had detectable cannabinoid urinary levels at the end of the 28-day abstinence period. Unfortunately, analytical results related to the cannabinoid testing in the article were scant as the primary objective of the study was to assess changes in aggressive behavior during withdrawal from long-term marijuana use. Even though this represents one of the best studies of chronic marijuana users, interpretation of this data for cannabinoid elimination purposes is limited because the actual drug testing data is not available. Nonetheless, Kouri, et al, shows that after at least 5000 marijuana smoking episodes, 30-day elimination times are possible.

A 2001 research project by Reiter et al. also seemed to avoid many of the design issues cited as concerns in Table 1. Reiter's case study involved 52 volunteer chronic substance abusers drug tested on a detoxification ward. Daily urine and blood tests excluded illicit drug consumption during the study. Using a 20 ng/mL immunoassay cutoff, the maximum elimination time (last time urine tested above the cutoff) for cannabinoids in urine was 433.5 hours (or just over 18 days); with a mean elimination time of 117.5 hours (4.9 days). When controlling for covert marijuana use by subjects during the study, chronic users in this study did not exhibit detectable urine cannabinoid levels for even three weeks.

In aggregate, using the data from the five studies cited in this review that researchers described as chronic marijuana users (even including data from Table 1), the average detection window for cannabinoids in urine at the lowest cutoff concentration of 20 ng/mL was just 14 days (Ellis, et al, 2002; Iten, 1994; Niedbala, 2001; Schwartz, Hayden, & Riddile, 1985; Swatek, 1984).

PERPETUATING THE 30-PLUS DAY ASSUMPTION

The assumption that cannabinoids can be routinely detected in urine following the smoking of marijuana for 30 days or longer appears widespread and longstanding. Exacerbating this problem is the nearly constant proliferation of published material that continually reinforces the 30-plus day cannabinoid detection window into the criminal justice psyche. Examples of the enormous body of information/literature that propagates the 30-plus day cannabinoid detection times abound:

- *Substance abuse treatment literature proclaiming that "some parts of the body still retain THC even after a couple of months."*²
- *Drug abuse information targeted toward teens that often presents unrealistic cannabinoid detection times such as; "Traces of THC can be detected by standard urine and blood tests for about 2 days up to 11 weeks."*³
- *Criminal justice publications that list the cannabinoid detection limits of a "Chronic Heavy Smoker" as "21-27 days."*⁴
- *Drug testing manufacturers' pamphlets that state the time to last cannabinoid positive urine sample as "Mean = 27.1 days; Range = 3-77 days."*⁵
- *General information websites that offer "expert" advice concluding, "The average time pot stays in your system is 30 days."*⁶
- *Urine tampering promotions in magazines such as High Times and on websites that offer urine drug cleansing supplements and adulterants intended to chemically mask the presence of drugs in urine often exaggerate the detection window in an effort to promote the continued use of their products. Some of their claims include: drug detection times in urine [for] "Cannabinoids (THC, Marijuana) 20-90 days,"⁷ and detection times for smokers who use "5-6x per week—33-48 days."*⁸
- *Health information websites that provide the following guidance; "At the confirmation level of 15 ng/ml, the frequent user will be positive for perhaps as long as 15 weeks."*⁹
- *Dr. Drew Pinsky (a.k.a. Dr. Drew), who has co-hosted the popular call-in radio show Loveline for 17 years, states that "Pot stays in your body, stored in fat tissues, potentially your whole life."*¹⁰

Based upon these information sources that claim cannabinoids elimination profiles of 25 days, 11 weeks, 90 days, up to 15 weeks after use, and for "your whole life," is it any wonder that drug court professionals cannot reach consensus on this issue? Is there any doubt why drug court clients make outlandish cannabinoid elimination claims in court? These represent but a sampling of the many dubious sources that perpetuate the prolonged cannabinoid detection window. As a consequence, the 30-plus day cannabinoid elimination period remains a commonly assumed "fact."

ESTABLISHING THE CANNABINOID DETECTION WINDOW IN URINE

The detection window for cannabinoids in urine must be seen in the proper context—as a reasonable estimate. Detection times for cannabinoids in urine following smoking vary considerably between subjects even in

controlled smoking studies using standardized dosing techniques. Research studies have also demonstrated significant inter-subject differences in cannabinoid elimination rates. The timing of marijuana elimination is further complicated by the uncertainty of the termination of use and continued abstinence. That said, general estimates for establishing a cannabinoid detection window in urine can be advanced and accepted for use in drug courts. Based upon the current state of cannabinoid elimination knowledge and the drug testing methods available in today's market, the following practical cannabinoid detection guidance is offered.

Based upon recent scientific evidence, at the 50 ng/mL cutoff concentration for the detection of cannabinoids in urine (using the currently available laboratory-based screening methods) it would be unlikely for a chronic user to produce a positive urine drug test result for longer than 10 days after the last smoking episode. Although there are no scientific cannabinoid elimination studies on chronic users using non-instrumented testing devices, one would assume that if the on-site devices are properly calibrated at the 50 ng/mL cutoff level the detection guidance would be the same.

At the 20 ng/mL cutoff concentration for the detection of cannabinoids in urine (using the currently available laboratory-based screening methods) it would be uncommon for a chronic marijuana smoker to produce a positive urine drug test result longer than 21 days after the last smoking episode.

For occasional marijuana use (or single event usage), at the 50 ng/mL cutoff level, it would be unusual for the detection of cannabinoids in urine to extend beyond 3-4 days following the smoking episode (using the currently available laboratory-based screening methods or the currently available on-site THC detection devices). At the 20 ng/mL cutoff for cannabinoids, positive urine drug test results for the single event marijuana use would not be expected to be longer than 7 days.

This cannabinoid detection guidance should be applicable in the majority of drug court cases. These parameters (acute vs. chronic), however, represent opposite ends of the marijuana usage spectrum. Clients will often exhibit marijuana-smoking patterns between these two extremes resulting in an actual detection window that lies within these limits. As noted in the Kouri, et al, study, research suggests that under extraordinary circumstances of sustained, extended and on-going chronic marijuana abuse (thousands of smoking episodes over multiple years) that 30-day urinary cannabinoid detection is *possible* in some individuals at the 20 ng/mL cutoff (1999). However, the burden of proof for documenting such aberrant and chronic marijuana use patterns should fall on the drug court client or the client's representatives. For a client to simply disclose "chronic" use is insufficient corroboration.

Much has been made about marijuana research that has produced dramatically prolonged cannabinoid elimination times, particularly in those subjects identified as chronic. This data has often been used to explain continuing positive cannabinoid test results in clients long after their drug elimination threshold (resulting in negative urine drug tests) should have been reached. The pertinent question: to what extent does the scientific data (demonstrating 30-plus day cannabinoid detection times in chronic users) influence the disposition of drug court cases? Put another way, do drug court practitioners need to be concerned about the potential of extended cannabinoid detection times impacting court decisions (i.e., sanctions)? In reality, the only timeframe in which an individual's chronic marijuana use (possibly leading to extended cannabinoid elimination) is relevant is during a client's admission into the drug court program. It is during this initial phase that the court may find itself attempting to estimate the number of days necessary for a client's body to rid itself of acquired cannabinoid stores and the time required to produce negative drug test results. In many programs, a detoxification

period is established for this purpose. Once in the drug court program (following the initial detoxification phase), the extent of a client's past chronic marijuana usage does not influence the cannabinoid detection window as long as appropriate supervision and drug monitoring for abstinence continues on a regular basis. It would seem reasonable to assume that chronic client marijuana usage of the extreme levels discussed here while within a properly administered drug court would be highly unlikely. Therefore, the consequences of chronic marijuana usage on the cannabinoid detection window are effectively limited to the initial entry phase of the program.

Science is not black and white and the state of our knowledge is continually evolving.

The cannabinoid detection window guidance provided herein relies upon the widely used cutoff concentrations for the initial screening tests—20 ng/mL and 50 ng/mL. For programs utilizing GC/MS confirmation for the validation of positive screening results, the confirmation cutoff has little influence on the length of the cannabinoid detection window in urine. A review of the potential result possibilities demonstrates this point. If a drug court sample tests negative for cannabinoids on the initial screen, the confirmation cutoff is obviously irrelevant because the sample is not submitted for confirmation testing. If a sample both screens and confirms as positive for cannabinoids (and is reported as positive), then the cutoff concentration of the confirmation analysis is also not relevant because the sample would not have been sent for confirmation unless it produced a result greater than or equal to the cutoff level of the initial screening test. In other words, the confirmation procedure is merely validating the results (and therefore the cutoff) of the original screening

test. The only scenario in which the confirmation cutoff could potentially impact the length of the cannabinoid detection window is if a sample screened positive and the confirmation procedure failed to confirm the presence of cannabinoids (and the results of the drug test were reported as negative). In this circumstance, the cannabinoid detection window might be *shorter* than the estimate provided as guidance. This would be true on the condition that the confirmation cutoff concentration was lower than that of the screening procedure—which is nearly always the case. A shorter cannabinoid detection window would not be seen as prejudicial to the client and might actually be beneficial to the drug court.

Using this cannabinoid detection window guidance, the drug court decision-making hierarchy should be able to establish reasonable and pragmatic cannabinoid detection benchmarks that both provide objective criteria for court decisions and protect clients from inappropriate or unsupportable consequences. Some courts may choose to use the cannabinoid elimination information detailed in this paper exactly as presented to establish a marijuana detection window that will allow the differentiation between abstinence and continued/renewed use. Other courts may decide to build into the guidance an additional safety margin, granting clients further benefit of the doubt. Regardless of the approach, however, courts are urged to establish detection benchmarks and utilize these scientifically supportable criteria for case disposition.

Every day drug courts grapple with two seemingly disparate imperatives—the need for rapid therapeutic intervention (sanctioning designed to produce behavioral change) and the need to ensure that the evidentiary standards, crafted to protect client rights, are maintained. While administrative decision-making in a drug court environment (or a probation revocation hearing) does not necessitate the same due process requirements and protections that exist in criminal cases, as professionals we are obliged to ensure that court decisions have a strong evidentiary foundation.

Courts establishing detection windows for cannabinoids need to be aware of the existence of research studies indicating prolonged elimination times in urine. It is not recommended, however, that drug courts manipulate their detection windows to include these exceptional findings. Sound judicial practice requires that court decisions be based upon case-specific information. In weighing the evidence, courts also acknowledge the reality that a particular client's individualities or the uniqueness of circumstances may not always allow the strict application of cannabinoid detection window parameters in a sentencing decision. These uncommon events, however, should not preclude the development of cannabinoid detection windows for the use in the majority of court determinations.

CLIENT DETOXIFICATION: THE "CLEAN OUT" PHASE

As a result of the extended elimination of cannabinoids (as compared to other abused drugs), some drug courts have instituted a detoxification stage or "clean out" period in the first phase of program participation. This grace period allows new clients a defined time frame for their bodies to eliminate stores of drugs that may have built up over years of substance abuse without the fear of court sanctions associated with a positive drug test. In many cases this detoxification period extends for 30 days, which corresponds to the commonly held assumption that this represents the time period required for marijuana metabolites to be eliminated from a client's system.

Regardless of the origin of the 30-day marijuana detection window and its influence on the duration of the detoxification period, 30 days is certainly an equitable time period for client drug elimination purposes. Simply because the science may not support the necessity of a detoxification period of this duration does not mean that a court cannot use the 30-day parameter in order to establish program expectations. However, based upon the

Courts are urged to establish detection benchmarks and utilize these scientifically supportable criteria for case disposition.

cannabinoid detection guidelines presented in this review, it is unlikely (utilizing reasonable physiological or technology criteria) that a drug court client would continue to remain cannabinoid positive at the end of this designated abstinence period. After 30 days, using either a 20 or 50 ng/mL testing cutoff, continued cannabinoid positive urine drug tests almost certainly indicate marijuana usage at some point during the detoxification period and should provoke a court response to reinforce program expectations.

ABSTINENCE BASELINE

The abstinence baseline can either be a point at which a client has *demonstrated* their abstinence from drug use via sequentially negative testing results (actual baseline) or a court-established time limit after which a client *should not* test positive if that client has abstained from marijuana use (scientific baseline). Each baseline has importance in a court-mandated drug monitoring program. The later has been the focus of this review. It is exemplified by establishing the detection window for marijuana and utilizing positive urine drug testing results to guide court intervention. Individuals who continue to produce cannabinoid positive results beyond the established detection window maximums (the scientific baseline) are subject to sanction for failing to remain abstinence during program participation.

The alternative approach uses negative test results in establishing the actual abstinence baseline. This has been referred to as the "two negative test approach" and has been

previously described in the literature (Cary, 2002). A drug court participant is deemed to have reached their abstinence baseline when two consecutive urine drug tests yielding negative results for cannabinoids have been achieved, where the two tests are separated by a several day interval. Any positive drug test result following the establishment of this baseline indicates new drug exposure. This technique can be used with assays that test for marijuana at either the 20 or 50 ng/mL cutoff concentration.¹¹

CANNABINOID TESTING FOLLOWING POSITIVE RESULTS

Due to the prolonged excretion profile of cannabinoids in urine (especially after chronic use) some drug court programs wrestle with the issue of whether to continue urine drug testing during the expected marijuana elimination period. Simply put, why continue the expense and sample collection burden for clients who have already tested positive for cannabinoids knowing that the client may continue to produce positive cannabinoid results for many days? There are at least three principle reasons drug courts are not advised to suspend urine drug testing following a positive result for cannabinoids.

First, most court-mandated testing includes drugs other than marijuana. Client surveillance often encompasses testing for many of the popularly abused substances such as amphetamines, cocaine, opiates, and alcohol. Programs that forego scheduled testing run the very real risk of missing covert drug use for substances other than marijuana. If a drug court client knows a positive cannabinoid test will result in a drug testing “vacation,” they may use that non-testing period to use substances with shorter detection windows (i.e. cocaine or alcohol). By continuing to test, the court maintains its abstinence monitoring for drugs besides marijuana.

Second, from a programmatic standpoint the suspension of scheduled client drug testing sends the wrong therapeutic message. If a

drug court's policies and procedures require a certain schedule of testing, suspending testing for even a short period may appear to other program participants that the court is “rewarding” a client who has tested positive. Eliminating scheduled drug tests in response to a positive cannabinoid result degrades the program's efforts at maintaining client behavioral expectations.

Lastly, depending upon the cutoff concentration of the drug test being used and whether the client's marijuana usage was an isolated event (rather than a full relapse), it is entirely possible that a client who has previously tested positive for cannabinoids may test negative sooner than the cannabinoid detection window estimate. As indicated earlier, acute marijuana use results in cannabinoid positive urine samples for only several days following exposure. Curtailing drug testing for longer than three days extends unnecessarily the period of uncertainty about a client's recent behavior and may delay appropriate therapeutic strategies or sanction decisions.

COURT EXPECTATIONS AND CLIENT BOUNDARIES

One of the most important prerogatives of drug court (or any therapeutic court) is to clearly define the behavioral expectations for clients by establishing compliance boundaries required for continued program participation. Drug testing used as a surveillance tool defines those boundaries and monitors client behavior in order that the court can direct either incentives or sanctions as needed to maintain participant compliance. To fulfill this important responsibility, drug courts teams must agree upon specific drug testing benchmarks in order to apply court intervention strategies in an equitable and consistent manner.

The primary focus of this article is to promote the establishment of a drug testing benchmark that defines the expected detection window of cannabinoids in urine following the cessation of smoking. In order for drug courts to determine their cannabinoid detection window,

the program will need to consider the cutoff concentration of the urine cannabinoid test being utilized and develop criteria for defining chronic marijuana users. Drug courts should also take into account how the cannabinoid detection window will be incorporated into their current policies and procedures and how the detection window will be used in case adjudication. Once established, the court should apprise program participants of the expectations associated with the cannabinoid detection window. Clients should understand that sanctions will result if continued cannabinoid positive tests occur beyond the established detection window (the drug elimination time limit after which a client should not test positive if that client has abstained from marijuana use). Courts are reminded that the cannabinoid detection window may require revision if there are modifications to the drug testing methods or if there are significant changes in marijuana usage patterns in the court's target population (i.e., significant increases in chronic use).

Practitioners are reminded that the goal in establishing a cannabinoid detection window is not to ensure that a monitored client is drug free. Chronic marijuana users may carry undetectable traces of drug in their bodies for a significant time after the cessation of use. Rather, the goal is to establish a given time period (detection window limit) after which a client should not test positive for cannabinoids as a result of continued excretion from prior usage.

Finally, the cannabinoid detection window is a scientifically supportable, evidence-based effort to establish a reasonable and practical standard for determining the length of time cannabinoids will remain detectable in urine following the smoking of marijuana. Drug courts are reminded that science is not black and white and that the state of our knowledge is continually evolving. While detection window benchmarks will and should guide the sanctioning process for violations of abstinent

behavior, courts are urged to judge a client's level of compliance on a case by case basis using all of the behavioral data available to the court in conjunction with drug testing results. In unconventional situations that confound the court, qualified toxicological assistance should be sought.

Paul L. Cary, M.S. is the Director of the Toxicology & Drug Monitoring Laboratory, University of Missouri Health Care, Columbia, Missouri; and NDCI Faculty Resident Expert on drug testing issues. Mr. Cary can be reached at carypl@health.missouri.edu.

This document was published with support from the Office of National Drug Control Policy, Executive Office of the President and the Bureau of Justice Assistance, U.S. Department of Justice.

References

- Baselt, R.C. (2004). *In Disposition of Toxic Drugs and Chemicals in Man, (7th ed.)*. Foster City, CA: Biomedical Publications.
- Cary, P.L. (2002). The use creatinine-normalized cannabinoid results to determine continued abstinence or to differentiate between new marijuana use and continuing drug excretion from previous exposure. *Drug Court Review, 4*(1), 83-103.
- Cridland, J.S., Rottanburg, D., & Robins, A.H. (1983). Apparent half-life of excretion of cannabinoids in man. *Human Toxicology 2*(4), 641-644.
- Dackis, C.A., Pottash, A.L.C., Annitto, W., & Gold, M.S. (1982). Persistence of urinary marijuana levels after supervised abstinence. *American Journal of Psychiatry, 139*(9), 1196-1198.
- Ellis, G.M., Mann, M.A., Judson, B.A., Schramm, N.T., & Tashchian, A. (1985). Excretion patterns of cannabinoid metabolites after last use in a group of chronic users. *Clinical Pharmacology and Therapeutics, 38*(5), 572-578.
- Huestis, M.A. (2002). Cannabis (marijuana): Effects on human behavior and performance. *Forensic Science Review, 14*(1/2), 15-60.
- Huestis, M.A., Mitchell, J.M., & Cone, E.J. (1994). Lowering the federally mandated cannabinoid immunoassay cutoff increases true-positive results. *Clinical Chemistry, 40*(5), 729-733.
- Huestis, M.A., Mitchell, J.M., & Cone, E.J. (1995). Detection times of marijuana metabolites in urine by immunoassay and gc-ms. *Journal of Analytical Toxicology, 19*(10), 443-449.

- Huestis, M.A., Mitchell, J.M., & Cone, E.J. (1996). Urinary excretion profiles of 11-nor-9-carboxy- Δ^9 -tetrahydrocannabinol in humans after single smoked doses of marijuana. *Journal of Analytical Toxicology*, 20(10), 441-452.
- Iten, P.X. (1994). In *Fahren untrer Drogen-o-der Medikamenteneinfluss. Forensische Interpretation und Begutachtung*. Zürich: Institut für Rechtsmedizin der Universtät Zürich.
- Johansson, E. & Halldin, M.M. (1989). Urinary excretion half-life of Δ^1 -tetrahydrocannabinol-7-oic acid in heavy marijuana users after smoking. *Journal of Analytical Toxicology*, 13(7/8), 218-223.
- Kouri, E. M., Pope, H. G. Jr., & Lukas, S. E. (1999). Changes in aggressive behavior during withdrawal from long-term marijuana use. *Psychopharmacology*, 143(3), 302-308.
- Niedbala, R.S., Kardos, K.W., Fritch, D.F., Kardos, T.F., & Waga, J. (2001). Detection of marijuana use by oral fluid and urine analysis following single-dose administration of smoked and oral marijuana. *Journal of Analytical Toxicology*, 25(7/8), 289-303.
- Reiter, A., Hake, J., Meissner, C., Rohwer, J., Friedrich, H.J., & Ochmichen, M. (2001). Time of drug elimination in chronic drug abusers: Case study of 52 patients in a "low-step" detoxification ward. *Forensic Science International*, 119, 248-253.
- Schwartz, R.H., Hayden, G. F., & Riddile, M. (1985). Laboratory detection of marijuana use. *American Journal of Diseases of Children*, 139(11), 1093-1096.
- Smith-Kielland, A., Skuterud, B., & Morland J. (1999). Urinary excretion of 11-nor-9-carboxy- Δ^9 -tetrahydrocannabinol and cannabinoids in frequent and infrequent drug users. *Journal of Analytical Toxicology*, 23(9), 323-332.
- Swatek, R. (1984). Marijuana use: Persistence and urinary elimination. *Journal of Substance Abuse Treatment* 1(4), 265-270.

Endnotes

1. EMIT is a registered trademark of the Dade Behring/SYVA Company and stands for (Enzyme Multiplied Immunoassay Technique). EMIT is a commercial drug testing product for the analysis of drugs of abuse in urine (d.a.u.).
2. *Detoxing from Marijuana* (pamphlet). (1992). Marijuana Anonymous: 12-Step Program for Marijuana Addicts, 4. The entire text reads as follows: "Why do some effects last so long?" "Unlike most other drugs, including alcohol, THC (the active chemical in marijuana) is stored

in the fat cells and therefore takes longer to fully clear the body than with any other common drug. This means that some parts of the body still retain THC even after a couple of months, rather than just the couple of days or weeks for water soluble drugs."

3. Website: TeenHealthFX. URL: <http://www.teenhealthfx.com/answers/12.html>. TeenHealthFX.com is a project funded by Atlantic Health System, a New Jersey hospital consortium. The website states that "the professional staff who answer questions from our vast audience and provide oversight include clinical social workers, health educators, adolescent medicine physicians, pediatricians and pediatric subspecialists, psychiatrists, psychologists, nurses, nutritionists, and many other health professionals."

QUESTION: "Dear TeenHealthFX, Smoking marijuana can be detected how long? I've heard a couple of weeks in urine, a couple of days in blood, and a couple of years in hair... please clarify! Also, during a routine physical at the doctor, will they check for marijuana in the blood or urine sample?"

Signed: Longevity Of Marijuana - How Long Does It Stay In Your System"

ANSWER: "Dear Longevity Of Marijuana - How Long Does It Stay In Your System, The chemical in marijuana, THC, is absorbed by fatty tissues in various organs. Traces of THC can be detected by standard urine and blood tests for about 2 days up to 11 weeks depending on the person's metabolism, how much they smoked and how long they smoked. THC can be detected for the life of the hair. Again, the sensitivity of the test ranges from person to person depending on many factors including the amount of body fat, differences in metabolism, and how long and how much they smoked."

Presumably, the 11 week estimate comes from the research finding of Ellis, et. al. (1985) which has been described earlier.

4. Bureau of Justice Assistance Monograph entitled: *Integrating Drug Testing into a Pretrial Services System: 1999 Update*, July 1999, NCJ # 176340. On page 48, Exhibit 5-3 titled; Approximate Duration of Detectability of Selected Drugs in Urine lists Cannabinoids (marijuana) Chronic heavy use as 21 to 27 days. Source: Adapted from the Journal of the American Medical Association's Council on Scientific Affairs (1987, p. 3112).

The source material citation is the Journal of the American Medical Association. (1987, June)

12;257(22):3110-4. The article is titled; "Scientific Issues in Drug Testing—Council on Scientific Affairs." On page 3112, Table 2. titled "Approximate Duration of Detectability of Selected Drugs in Urine" lists chronic heavy smoker as 21-27 days. The references cited for this data are Dackis, et. al (1982), and Ellis, et. al. (1985), the potential shortcomings of both have been discussed in this article. It is noteworthy and illustrative that this 1999 "updated" publication still relies on research performed in 1982 and 1985.

5. *Cannabinoid Issues: Passive Inhalation, Excretion Patterns and Retention Times* (pamphlet). Dade Behring, SYVA Company, S-10036. On page 25 in a table titled: "Emit d.a.u. Cannabinoid Assay (20 ng/mL)" is listed the following:

All Subjects (n = 86):

First Negative:

Mean = 16.0 days Range = 3-46 days

Last Positive:

Mean = 27.1 days Range = 3-77 days

Examination of the references associated with this data indicates the following sources; Ellis, et. al. (1985), Schwartz, Hayden, & Riddile (1985), and Johansson & Halldin (1989). All of these references and their potential study design issues have been reviewed in this article. This pamphlet also contains cannabinoid elimination data using the Emit-st Cannabinoid Assay testing method. Given that this assay is no longer being manufactured, the data was not included.

6. Website: *What You Need to Know*. About.com URL: <http://experts.about.com/q/1319/718935.htm>. This is a popular website for general information inquiries about almost any subject matter. In a section entitled "About Our Service" the website states, "Allexperts, created in early 1998, was the very first large-scale question and answer service on the net! We have thousands of volunteers, including top lawyers, doctors, engineers, and scientists, waiting to answer your questions. All answers are free and most come within a day!"

The question submitted to the site was, "How long does marijuana stay in your system?" The expert response was: "The average time pot stays in your system is 30 days. The time may differ depending on your metabolism. If you have a fast metabolism it may be shorter than 30 days, if you have a slow metabolism it may be more. The average though is about 30 days." Note that in this answer, 30 days is given as an average cannabinoid elimination time.

7. Website: Health Choice of New York. URL: <http://www.clearchoiceofny.com/drugtestinfo.htm>. This website states: "It's One Stop Shopping For All Of Your Detoxifying Needs. We Have All The Products You Need To Pass A Urine Drug Test." In a section entitled "Drug Approximate Detection Time in Urine," the site provides the following information: "Cannabinoids (THC, Marijuana) 20-90 days."
8. Website: IPassedMyDrugTest.Com. URL: http://www.ipassedmydrugtest.com/drug_test_faq.asp#detect_time

The following table is provided:

Cannabinoids (THC, Marijuana) Detection Time:

1 time only	5-8 days
2-4x per month	11-18 days
2-4x per week	23-35 days
5-6x per week	33-48 days
Daily	49-63 days

9. Website: HealthWorld Online. URL: <http://www.healthy.net/clinic/lab/labtest/004.asp>. Site's mission statement; "HealthWorld Online is your 24-hour health resource center—a virtual health village where you can access information, products, and services to help create your wellness-based lifestyle." In the section called "Detection of Cannabinoids in Urine," the following information is provided: "Cutoff and Detection Post Dose: The initial screening cutoff level is 50 ng/ml. The GC/MS cutoff level is 15 ng/ml. The elimination half-life of marijuana ranges from 14-38 hours. At the initial cutoff of 50 ng/ml, the daily user will remain positive for perhaps 7 to 30 days after cessation. At the confirmation level of 15 ng/ml, the frequent user will be positive for perhaps as long as 15 weeks."

10. Website: Dr. Drew. URL: <http://drdrew.com/Office/faq.asp?id=1083§ion=5002>

QUESTION: How long does pot (or other drugs) stay in your body? Is there any way to detect it?

ANSWER: Most readily available drug screens are tests of the urine. Blood tests and breath analyzers are another way substances can be detected. Pot stays in your body, stored in fat tissues, potentially your whole life. However, it is very unusual to be released in sufficient quantities to have an intoxicating effect or be measurable in urine screens. Heavy pot smokers, people who have smoked for years on a daily basis, very commonly have detectable amounts in their urine for at least two weeks.

11. Research data indicates that in the terminal phase of cannabinoid elimination, subjects can produce urine samples with levels below the cutoff concentration (negative results), followed subsequently by samples with levels slightly above the cutoff (positive results) (Huestis, 2002). This fluctuation between positive and negative did not occur in all subjects and in those that did exhibit this pattern, the fluctuation was generally transitory. Based on this elimination pattern, it is recommended that programs using a cannabinoid cutoff of 50 ng/mL allow an interval of at least three days between the two negative result samples to establish the abstinence baseline. It is further recommended that programs using the 20 ng/mL cannabinoid cutoff allow an interval of at least five days between the two negative result samples to establish the abstinence baseline. If a program's testing frequency is greater than every five days (using the 20 ng/mL cutoff), a total of three or more negative tests may be required before the five-day interval is achieved.

Publisher

C. West Huddleston, III

Director, National Drug Court Institute

National Drug Court Institute

4900 Seminary Road, Suite 320

Alexandria, VA 22311

703.575.9400 ext. 13

703.575.9402 fax

whuddleston@ndci.org

FACT SHEET QUIZ: WHAT DID YOU LEARN?

Test your new knowledge. Answer these true and false questions based on the Fact Sheet text.

T F 1. The "detection window" means the length of time a drug will remain in someone's system.

T F 2. The choice of testing cutoff has a profound effect on the cannabinoid detection window.

T F 3. Despite changes in testing methodologies, detection times of cannabinoid metabolites in urine monitored by immunoassay have remained the same over the past two decades.

T F 4. Chronic users of marijuana commonly produce a positive urine drug test result 30 days after the last smoking episode.

T F 5. Any positive drug test result following two successive negative urine drug tests several days apart indicates new or recent drug exposure.

T F 6. Since marijuana has such a prolonged elimination period, temporarily suspending drug testing of a client who tests positive for marijuana is a good money-saving strategy.

Answers: 1. False; 2. True; 3. True; 4. False; 5. True; 6. False



NATIONAL DRUG COURT INSTITUTE

4900 Seminary Road, Suite 320

Alexandria, VA 22311

(703) 575-9400

1-877-507-3229

(703) 575-9402 Fax

www.ndci.org