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Hair Analysis As a Drug Detector

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National Institute of Justice

Research in Brief

Jeremy Travis, Director

October 1995

Issues and Findings

Discussed in this Brief: An NIJ-sponsored study of the viability and effectiveness of testing hair samples for drug use among probationers, which was conducted with the assistance of correctional officers from divisions of the Florida Department of Corrections Probation Field Services.

Key issues: Because urine testing of drug offenders is known to be particularly burdensome, a pilot study was developed to determine whether hair assays, which are noninvasive and have a larger window of detection, could be more effective. Over a 6-month period, volunteer probationers were tested for a variety of substances. Researchers also questioned the field officers about their opinions as to the usefulness of the testing.

Key findings: Researchers used both methods to test for cocaine, opiates, marijuana, and other drugs. Among their findings:

- Hair analysis is a better indicator of cocaine use over an extended timeframe and can more accurately identify a chronic drug user. Urine analysis, on the other hand, is better able to measure short-term exposure to cocaine.

- Urine analysis seems to be a better way to detect opiates, particularly the presence of codeine. Hair

Hair Analysis As a Drug Detector

by Tom Mieczkowski, Ph.D.

Testing hair samples for drugs of abuse may offer certain advantages over urine testing methodologies. Drugs and drug metabolites remain sequestered in the hair shaft indefinitely, thus providing detection during a much larger "window" (approximately 60 days of use can be seen in one inch of hair) than drug levels in urine, which decrease rapidly, through excretion, over a short period of time (generally within 48 to 72 hours). From an operational standpoint, the collection, transportation, preservation, and storage of nonseptic and inert hair samples are simple processes and relatively noninvasive when compared to those associated with collecting observed urine specimens.

An NIJ-sponsored pilot study assessed the feasibility and effectiveness of doing hair assays in a probationary field setting and the attitude of probation officers regarding hair testing.

Recruitment and retention of probationers

Twenty-two correctional officers from divisions of the Florida Department of Corrections Probation Field Services voluntarily participated in this study. Officer-volunteers were asked to solicit from each of their caseloads 8-10

volunteers who were currently undergoing at least monthly urine testing. A simple hair collection procedure was incorporated into the officers' appointment routine, but no information on the outcome of the hair assays was used in any aspect of case management. At each appointment the officers collected a urine specimen and a hair specimen from the probationer.

Of the 152 volunteer probationers initially recruited for the project, 91 participated for the entire 6-month collection period, and complete specimens were collected for 89. The study cohort was predominantly male (72 men versus 19 women) and white (87 Caucasians, 3 African Americans, and 1 Hispanic were represented). Researchers attributed the low number of African-American participants to demographics of Pinellas and Pasco county regions (only about 7 percent of the population in these counties is African-American), as well as to the fact that young African-American males were likely to have extremely short head hair; the project did not attempt to retrieve body hair samples.

Hair and urine specimens were conjointly analyzed for cocaine, opiates, cannabinoids, PCP, and methadone. Cutoff values for hair analysis (2 ng/10 mg for cocaine and heroin, and .05 ng/10 mg for cannabinoids) were recommended by the testing

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Issues and Findings

continued

assays are designed to detect morphine-based compounds.

- Both hair and urine tests appear to have equal effect in detecting the presence of marijuana.

- Hair and urine testing can complement one another because of their capacity to expose different patterns of drug use.

- The field officers agreed that hair testing for drugs can be beneficial in their efforts to manage their cases and to track drug use over a longer time period. Most of the officers agreed that gathering hair for tests was less difficult than collecting urine samples.

Target audience: Probation/parole officers, law enforcement officials, policymakers, and researchers.

laboratory, and NIDA-established cut-offs (300 ml/150 for cocaine, 300 ml/300 for heroin, and 100 ml/15 for marijuana) were used for urinalysis.

Outcomes of hair and urine assays

Complete sets of hair and urine specimens were obtained from 89 probationers. Of these, 36 were negative on both hair and urine assays, and 33 were positive on both hair and urine assays. In 12 cases, probationers tested negative on the urine assays and positive on the hair assays; in 8 cases, probationers tested positive on the urine assays and negative on the hair assays. Of the 89 complete cases, 53 had a positive assay on at least one hair or urine sample. (See table 1.) A slightly higher number of drug-positive cases was detected in the hair assays (45) than in the urine assays (41).

Cocaine. The main criteria for measuring effectiveness of cocaine detection in this study were the ability of hair analysis to identify periodic or chronic exposure to the drug and the ability of urinalysis to measure acute or short-term exposure. Of the 89 completed cases, there were none in which a probationer's urine specimen tested cocaine-positive and hair specimen tested cocaine-negative. This pattern, according to the study, sug-

gests that hair analysis is effective in identifying periodic cocaine exposure.

Opiates. The research team was interested in evaluating the detection of chronic opiate use by analysis of hair (see table 2) and comparing those findings to the outcomes of urinalysis and any self-reports for opiates. Two problems arose, however. The major limitation was that there were very few opiate-positive cases within the sample. Secondly, the hair assay for opiates is somewhat more limited than urinalysis; the hair assay was not designed to detect codeine while the urine assay did detect codeine. Thus, the two assays were not comparable.

Opiates were much less prevalent than cocaine or marijuana. Of all subjects in the study, only 11 had one or more opiate-positive hair samples, and 14 had opiate-positive urine samples. These findings include five cases in which urine samples were positive for opiates but the corresponding hair assays were opiate-negative. In one of these five cases, three opiates were detected in urine samples, but none were detected in hair. In the four remaining cases, the urine-positive, hair-negative outcomes appeared at either the first or the fifth or sixth urine samples. Several interpretations of these data are possible. The hair assay may be less effective for opiates

Table 1: General Outcomes for All Cases

Assay Result	Number of Samples	Number of Cases
(-) Assays Both Specimens	6	36
	Less than 6	26
(+) Assays Both Specimens	6	33
	Less than 6	25
(-) Urine Assays (+) Hair Assays	6	12
	Less than 6	7
(+) Urine Assays (-) Hair Assays	6	8
	Less than 6	5

man for other drugs. Alternatively, the urine assay may be detecting the presence of codeine from abused medicinals, while the hair assays (which detect morphine-based compounds) show a negative because the person has not consumed heroin or morphine. Possibly the opiates were near or under the limit of detection in the hair assays; or, in the cases where the urine-positive result occurred at the end of the study (i.e., in the fifth or sixth sample), the hair may not have had sufficient time to emerge above the scalp (i.e., the sample was taken too early relative to the time the drug was consumed).

Marijuana. Marijuana was the most prevalent drug detected within the sample group by either type of assay. When considering all cases (completed or not), 53 marijuana cases accounted for a total of 149 marijuana-positive hair samples (out of a total of 503 hair assays and 690 urine assays—see table 3.) The most likely outcome for any completed case, over the full 6-month period, was that the hair and urine assays for marijuana would be concordant, though not necessarily for the same timeframe. For example, of the 89 completed cases, in 33 at least 1 positive assay for a drug occurred in at least 1 specimen (either hair, urine, or both). Of those 33 cases, 24 had a marijuana-positive assay. Of those 24, 16 had a marijuana-positive assay in hair only; 3 had a marijuana-positive assay in urine only. This suggests that, generally speaking, the hair assay for marijuana is about equal in effect to the urine assay. It does not show the enhanced detection capability that appears to be true for cocaine assays, but the researchers believe that this result is to be expected. Marijuana may be detected in urine for a

relatively long period of time (compared to cocaine), and one would not expect as dramatic a departure in detection rates for a drug with long urine retention times.

Other drugs. There were no detections of PCP or methadone in the sample group.

Participant opinions and experiences

Field officers. Participating officers varied widely in their estimates of the degree of probationer drug involvement among their cases; the mean value of estimated drug-user cases was 38.8 percent (s.d. = 18.6 percent). This was quite accurate since 40.4 percent of the participating probationers had one or more positive assays (either hair, urine, or both). If urinalysis alone were used, only 9.8 percent of these probationers would have been detected as positive. Nearly all officers supported the concept and practice of probationary drug testing, when properly conducted. Most officers said that collecting hair samples was less burdensome than collecting urine specimens. The researchers observed that officers were readily able to collect, package, and transport hair samples and to obtain probationers' cooperation.

Many officers perceived hair testing as a way to manage their cases more effectively. For example, their ability to sort a series of drug-positive clients into rank order categories such as "heavily," "moderately," or "casually" exposed would be enhanced, as would their capability to track drug use retrospectively (especially cocaine) over a longer timeframe.

Probationers. Probationers ranged in age from 17 to 53 years, with a mean age of 29.63 years (s.d. = 7.81) and a median age of 29 years. Drug possession was the single most frequent offense charged against this group, with drug sales, assault, and larceny following closely behind.

Probationers were asked about their lifetime drug habits. When asked about cocaine, 45.5 percent admitted some lifetime use; 35.5 percent admitted monthly use; and 28.8 percent admitted weekly or greater use. Regarding marijuana, 71.1 percent admitted some lifetime use.

Implications

The researchers suggest that hair assay technology could usefully be combined with urine testing in probation population management. For example,

Table 2: Opiates Detected by Hair Assay

Number of Opiate (+) Hair Samples*	Frequency	Percent
1 (+) Sample	5	3.3
2 (+) Samples	2	1.3
3 (+) Samples	2	1.3
4 (+) Samples	1	.7
6 (+) Samples	1	.7

*The table shows the number of opiate (+) hair samples for all cases on which any samples were collected. For example, it shows that five cases had one (+) opiate sample, two cases had two (+)'s and two also had three (+)'s.

Table 3: Hair Assays for Marijuana, All Samples

Number of Hair (+) Marijuana Samples	Frequency	Percent
1 (+) Sample	15	11.4
2 (+) Samples	15	11.4
3 (+) Samples	6	4.5
4 (+) Samples	6	4.5
5 (+) Samples	4	3.0
6 (+) Samples	7	5.3

hair testing could be used as an initial screen for the identification of long patterns of drug use, especially cocaine. Individuals with indications of severe drug involvement could be placed on appropriate treatment and monitoring, utilizing both urine and hair testing, for example. Those who indicate a low level of exposure and whose claims are consistent with as-

say results might be assigned to a less intensive protocol involving, for example, hair testing every 60 days supplemented by a random urine testing requirement. Under such a system, the data of this project indicate that the detection of users will be enhanced and will conform more closely to the self-reported levels of use and the probation officers' expectations of use.

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Copies of the unpublished full report prepared for NIJ grant #92-IJ-CX-K010, "Hair Assays for Drugs of Abuse in a Probation Population: Implementation of a Pilot Study in a Correctional Field Setting," by Tom Mieczkowski, Ph.D., Richard A. Newel, Gail Allison, and Shirley Coletti, are available on interlibrary loan or as photocopies for a minimal fee. Call NCJRS, 800-851-3420; ask for NCJ 152420.

Findings and conclusions of the research reported here are those of the authors and do not necessarily reflect the official position or policies of the U.S. Department of Justice.

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