

Using Emerging Technology to Combat Substance Abuse among Offenders under Supervision

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According to the Center for Substance Abuse Prevention, over one third of all arrests are related to unlawful use or possession of drugs and alcohol.ⁱ This does not include property crimes committed by offenders needing money to support a drug or alcohol habit. Sixty percent of men and 50% of women arrested for property crimes tested positive for drugs or alcohol at the time of their booking.ⁱⁱ Adding these categories together, we find that over 80% of all arrests involve, to some degree, substance abuse. Offenders typically continue abusing substances when they are back in the community. According to a Michigan report, 48% of offenders will be returned to prison.ⁱⁱⁱ Substance abuse is a leading contributor to this recidivism rate. A classic study done by Bureau of Justice found that 77.2% of offenders who committed an offense while under the influence of drugs or alcohol continued to abuse these substances while under a subsequent period of community supervision of one year or longer. If the initial offense was motivated to obtain money to buy drugs, the rate of continued substance use while under supervision rose to staggering 84%.^{iv} The cycle of substance abuse and imprisonment, to say the least, is placing a serious strain on the criminal justice.

By implementing a comprehensive strategy at combating substance abuse among offenders under supervision, criminal justice agencies can make great strides at breaking this cycle. Even with a modest reduction in the rate of substance abuse among probationers and parolees, the criminal justice system would be transformed. Chronic prison overcrowding conditions and staggering caseloads of the community corrections workers would be curtailed. Such an accomplishment can only occur if there are effective detection tools available that can

quickly and cost effectively identify drug use among those under the criminal justice system's jurisdiction.

Shortcomings of Urinalysis Only Programs

The most common testing technique to detect substance abuse among the offender population is urinalysis. Virtually every probation/parole agency uses or has used this methodology. The advantage of using a laboratory analysis of urine is the reliability of the results, the relatively wide window of detection and the admissibility of the results as evidence in revocation proceedings. Agencies using instant urinalysis kits trade off some of the reliability for quicker results. Whether using a laboratory or an instant kit, the process is rather invasive. Most agencies require the sample collection process to be observed to decrease the likelihood of circumvention. For obvious reasons, this process is uncomfortable for both the offender and the collecting officer. Furthermore, an officer of the same gender must be available to perform the collection. This is not always possible, often resulting in offenders not being tested as often as they should.

The cost of relying upon urinalysis alone to detect the substance use of offenders can be prohibitive. A small agency that tests each of its 1,000 offenders once each month using a laboratory may spend well over \$100,000 annually for initial drug screening. The expense of confirming positive specimens can nearly double that cost. With many agencies experiencing tight budgets, limitations on drug testing is often ordered. Although this may make sense to the accounting staff, seasoned corrections officials know that the long-term costs of not testing offenders for drug use can far outweigh any short-term savings.

Agencies are searching for reliable methodologies for testing offenders for drug use that will not break the bank. Several technologies and methodologies are now emerging that show

some promise, but they should be carefully evaluated before being adopted by an agency. A careful selection of multiple methodologies may be the proper path for many agencies. Several of the emerging technologies will be discussed, allowing programs to decide whether implementing one or more these approaches can result in maintaining a robust drug testing protocol while staying within the constraints of a limited budget.

Detection Methodologies

There are currently at least ten methods used by agencies to test for offender drug usage. Each approach has advantages and disadvantages that may not be well known. With so many choices and relatively little information made available, it is easy to understand how program managers can have a difficult time developing a good drug detection strategy. This class will briefly outline the methodologies currently available while spending most of the time on some of the newer and lesser known technologies that are emerging.

The following are methodologies currently used to detect drug and/or alcohol abuse:

Blood Testing - The analysis of blood to locate the presence of metabolites of drugs and/or alcohol (ethanol)

Urinalysis - The analysis of urine to locate the presence of metabolites of drugs and/or alcohol

Saliva Testing - The analysis of saliva to locate the presence of metabolites of drugs and/or alcohol

Breath Analysis - The analysis of breath to detect the presence of alcohol

Hair Analysis - The analysis of hair to locate the presence of metabolites of drugs

Sweat Testing (patch) - The testing of perspiration secreted from the pores of skin tissue onto an absorbent patch to locate the presence of drugs or alcohol.

Sweat Testing (automated) - The testing of perspiration secreted from the pores of skin tissue by a fuel cell to detect the presence of alcohol (ethanol).

NIR Absorption Spectroscopy - The detection of alcohol (ethanol) accomplished by analyzing near infra red light as it is directed into the skin and surrounding tissues

Automated Pupilometry - The detection of drug or alcohol impairment accomplished by evaluating the pupils' reaction to light

Actigraphy - The detection of possible drug or alcohol impairment by evaluating sleep patterns

A few of these drug detection methodologies are very familiar. Therefore, this discussion will focus on the approaches that are more likely to be unfamiliar with the student. Little time will be spent discussing urine and blood testing. Instead, students will be encouraged to consider supplementing their urine and/or blood testing protocols with one of these other methodologies in order to enhance their agency's ability to detect illicit substance use more effectively and efficiently.

The Detection Window

Before going any further, the concept of the “detection window” must be discussed. The detection window is the period of time a drug or its metabolite remains detectable. The window can be impacted by a number of factors, including:

- The testing protocol used
- The drug used
- The amount and frequency of the drug used
- The size of the person tested
- The person's metabolism
- The individual's tolerance to a drug
- The intentional or unintentional cleansing of the drug from the system

Some testing protocols, such as saliva, breath and pupilometry can detect the presence or effect of a drug very quickly, often within minutes of ingestion, while many of the remaining approaches may not detect the drug (or its effect) for many hours or even days. Typically, the methods that can detect drug or alcohol usage the earliest are also the ones that are first to stop detecting the substances as time passes. Similarly, the methodologies that do not begin to detect illicit substance until long after ingestion are also the ones most likely to have a later window of

detection. It is important that the objective of the program is consistent with the methodologies chosen. For example, a program that tests for drug use only once each month should consider a technology that has a longer detection window. On the other hand, an officer checking for driver impairment during a vehicle stop needs a technology that will have a detection window that opens early.

Many times agencies mistakenly discredit a new technology when comparing it against their standard detection method. For example, an agency that has uses urinalysis may choose to try saliva testing. The agency may decide to use both methodologies at the same time to “validate” the new approach. When the results of the saliva test differ from the urinalysis test, they mistakenly assume that saliva testing is unreliable. Instead, the agency should have considered the significantly different detection windows between the two approaches. Both tests can be accurate in such cases.

Drug Testing Technologies

Gas chromatography - mass spectrometry analysis of blood and urine are both well known alcohol and drug detection methods and are both considered to be the “gold standard” of reliability and court admissibility. The use of instant urinalysis kits is also very popular. Although some jurisdictions use these kits as initial screening and follow up any positive results with laboratory confirmation, some agencies have been able to introduce the kit results as prima fascia evidence for revocation proceedings. Regardless, this course recognizes that urinalysis testing is familiar to virtually all probation and parole agencies and a prolonged discourse on the topic is not needed. However, many agencies know far less about other drug detection techniques. Their detection windows, reliabilities and potential uses within the criminal justice system unknowns. This following section attempts to briefly introduce these methodologies and

discuss their potential applications in detecting substance abuse among offenders under supervision. Although many of these technologies are associated with common trade names, the trade names are not used in the body of this lecture. However, in the Appendix, reference is made to trade names when there is only one vendor marketing a particular technology.

Saliva Testing:

The greatest appeal to saliva testing is the collection of the specimen can be performed by any officer in almost any environment. In fact, multiple tests can be completed simultaneously while offenders are stationed in a waiting room. The collection process is much less evasive than urinalysis and it eliminates the issue of shy bladder syndrome, where an offender claims he cannot produce a specimen while being watched. The gender matching issue is also eliminated.

There are currently two basic approaches to saliva testing. Both methods involve the placement of a small sponge (attached to a stick) inside the mouth, usually between the cheek tissue and the teeth. Within a few minutes, the sponge is sufficiently saturated with saliva that a drug test can be completed. With one approach, the sponge is placed in a small container and prepared for shipping for laboratory testing. The other method allows for the instant testing for drugs, similar to a urinalysis instant test kit.

There is a downside to saliva testing. First, because the sample size is relatively small when compared to a urine specimen, more sensitive equipment is needed. This often makes saliva testing much more expensive than urinalysis. The relatively small sample size can also make it difficult to retest the specimen if the results are disputed. This is especially true of the instant kits. Like urinalysis, the results may need to be confirmed before they can be admitted into court as evidence. Under the best of circumstances, there may be a sufficient sample size to

accomplish this. However, if the offender requests an independent analysis from another laboratory, there is little chance that a third test can be completed.

A significant advantage to saliva testing is the lack of circumvention schemes available to the offender. Saliva is not affected by flushing or the use of cleansing agents that are often used to combat urinalysis testing. With proper supervision of the collection process, it is virtually impossible to adulterate saliva or to substitute someone else's specimen for testing.

The detection window opens earlier and closes more quickly for saliva testing when compared to urinalysis. Depending on the offender's drug of choice and his/her reporting frequency, this could also be a disadvantage. If an agency collects specimens once each month, more illicit drug use will be detected with urinalysis because the detection window stays open longer. However, if a program collects specimens several times each week, the length of the detection window is not as important. In fact, more illicit drug use may be detected with saliva testing where specimens are collected frequently because the detection window opens more quickly.

Breath Analysis

When alcohol is the offender's drug of choice, breath analysis is an option that is fast, accurate and relatively inexpensive. Two approaches are used to detect alcohol with breath. The one-time use, disposable kit is a tube filled with a granular substance that changes color when a certain concentration of breath alcohol passes through it. Kits that have differing thresholds can be purchased (for example, .02, .04, .05, and .08 BAT levels). These devices are small, portable, accurate and relatively inexpensive. Some jurisdictions may require a secondary confirmation test, such as urinalysis, to confirm positives before the results can be used in court. The collection methods may be a bit problematic. The offender must blow into the disposable tube

for approximately 10 seconds in order to obtain a valid sample. It may be difficult to monitor the offender's rate of exhalation which could compromise the validity of the test.

The second approach is the use of digital breath alcohol testing devices. The portable devices have recently become more affordable. The testing equipment works by blowing a constant flow of breath through a gas detector for a period of several seconds. If the test was performed properly, the results are displayed digitally within seconds. Again, the most common method for circumventing the testing process is to not provide enough breath to provide valid results. Most systems will indicate that insufficient breath flow or duration has occurred. Tobacco smoke and mouthwashes, if used immediately prior to testing, can create misleading results. Some models may require periodic calibration, especially if the results of the testing are to be used in court. Some jurisdictions may require urinalysis to confirm positive results.

Hair Analysis

Another non-intrusive technology that can be used to detect substance use is hair analysis. Hair, like urine, is a waste product that contains metabolites of many commonly abused drugs. While these metabolites may be quickly eliminated through urine, they provide a lasting historical log of substance abuse within the shafts of hair. Approximately 60 days of drug use can be detected in one inch of hair, with the more recent usage being detected in the hair shaft closest to the scalp.^v

Collection of hair samples is typically viewed as much less intrusive than collecting a urine specimen. Hair is sterile, inert and does not pose a risk of passing on disease. There is a remote chance that hair infestations, such as lice, could potentially pose a minor health threat to the collector. Use of latex gloves and proper post-collection hygiene can virtually eliminate this concern.

The detection window for hair opens very late and stays open indefinitely (or until the hair is cut). Although hair grows just an inch in 60 days, evidence of drug use found through hair analysis can occur as early as six days after ingestion.^{vi} Still, this is not the testing methodology to choose if detection of recent use is needed. However, this approach may be ideal for initial drug screening to determine an offender's substance abuse history over the past year. Supervising officers may discover a pattern of drug use that would have otherwise never been identified.

According to a 1997 Department of Justice study, when compared to urinalysis testing, hair analysis was actually a better indicator of cocaine use over an extended time. Both methodologies were effective in detecting marijuana, but hair analysis was not quite as effective in uncovering opiate use.^{vii}

Transdermal testing methods

An interesting approach to detecting illicit drugs is the testing of sweat. "Transdermal" means "across the skin", and usually refers to a method of administering a medication, such as an ointment or topical cream. However, when using the term in relation to drug detection, it refers to the collection of perspiration being excreted by the skin.

This detection technique can be accomplished in two ways. The first uses a patch that remains on an offender for an extended period of time, usually a week or more. As the individual perspires, the patch absorbs and retains metabolites of many commonly abused substances. After the patch is removed, it is sent to a laboratory for testing.

Environmental contamination is a concern. If an offender enters an area where drugs are present, traces of the substances can adhere directly to the offender's skin, resulting in a false

positive report for drug use.^{viii} Also, offenders vary in their rates of perspiration causing the detection of illicit drug use of some offenders more likely than with others.^{ix}

The second transdermal technique provides automated continuous detection. Currently this approach can only reliably detect alcohol usage, but promising research results indicate other illicit substances may soon be detectable using this methodology. The offender is required to continually wear an ankle bracelet equipped with an alcohol “sniffing” device called a fuel cell. This is a complex technology that converts alcohol to acetic acid. During the conversion process, a small electrical charge is generated. The more alcohol that is present, the stronger the electrical charge will be. By measuring the current, an approximate concentration of alcohol within the offender’s body can be established.^x This technology is also commonly found in the breath alcohol devices discussed earlier.

The ankle bracelet device typically collects data throughout the day and then downloads the information via a cell phone or an RF link connected to the offender’s telephone. A trained technician looks for evidence of alcohol consumption and submits the findings to the supervising agency. Some vendors’ devices simply report an incident where alcohol is detected above an established threshold. This is sometimes problematic as incidental exposure to environmental alcohol can generate false alerts. An approach that eliminates most of these false positives requires an analysis of data over time. The plotted curve of alcohol levels during the consumption and dissipation periods can be used to easily distinguish a true violation as opposed to an incident where an offender had unwittingly been exposed to alcohol in the environment.

The detection windows of both transdermal testing methods are superior to many of the other techniques. Because the devices are continually collecting or analyzing perspiration over an extended period of time, nearly all violations should be discovered.

NIR Absorption Spectroscopy

When research scientists were considering alternative methods of measuring glucose levels in the blood of diabetics, they thought near infrared spectroscopy could be a promising solution. The process would eliminate the need for painful lancets that pricked the patients' fingers. Although their experimentation found the screening of glucose levels to be challenging, they discovered the process was very effective in measuring alcohol levels in the blood.

When shining NIR light into the skin, wavelengths of the light are absorbed into specific molecular structures uniquely. These "spectral absorption signatures" can be used to identify a particular substance.^{xi} Unfortunately, the process has not yet been refined to the point where most common drugs of abuse can be detected. However, the spectral absorption signature of alcohol is readily identifiable with a very high level of accuracy. In fact, the work of Benjamin Ver Steeg and Trent Ridder show the technology can quantify the concentration of alcohol in the bloodstream more accurately than breathalyzers.^{xii}

The process involves the offender placing his/her bare forearm arm onto a flat panel. Light is shone into and through the skin from the NIR emitters located on the panel under the offender's arm. Within a minute, test results will indicate whether the offender has alcohol in his bloodstream. There is an interesting and beneficial twist to the technology. Because individual's skin tissue composition is about as unique as a human fingerprint, the device also has biometric identification capabilities. Therefore, once an offender has been enrolled into a database during the first testing process, the equipment will recognize that individual when he/she returns for subsequent testing. The results of all the testing can be systematically logged into an offender's file with little intervention from the supervisory staff.

The equipment is more expensive than most basic breathalyzers, but may be considered more hygienic by some agencies. No other alcohol detection technology has an on-board

biometric feature. Although the reliability of the technology is very impressive, certain environmental contaminants may create false positives. For example, the manufacturer has disclosed that alcohol based hand disinfectants (i.e. Purell) placed on the skin immediately prior to testing may cause erroneous results. The detection window is similar to that of blood testing.

Automated Pupilometry

It is said the eyes never lie. Could an instrument that examines how the eyes respond to light get to the truth about an offender's drug usage? It is well known that many drugs have a noticeable effect on the size of pupils. It is also well established that drugs can impact a pupil's ability to respond to light. The developers of an innovative technology believe a device, called a pupilometer can precisely measure these variables and predict what substances are on board the tested individual. Because the system measures physiological responses at the time of testing, it is likely that the detection window for this approach is comparable to blood testing.

Remote drug testing using a pupilometer is now possible. Federal Probation Officers in the states of Hawaii and Montana are using specially equipped kiosks to allow selected offenders to report in without travelling to the office. These kiosks contain pupilometer devices along with fingerprint biometrics to assure the testing is done properly and securely. According to a presentation made in Denver, CO at the Innovative Technologies for Community Corrections conference in June of 2008, US Probation official Stace Kubota of Honolulu, indicated the remote drug testing feature was promising, but not yet perfected.

At this point, positive pupilometer test results should only prompt an agency to do further testing. The reliability of the technology has not yet passed the rigors of the courts. However, an agency may find that initial screening with a pupilometer can provide substantial savings for a drug testing budget.

Actigraphy

Individuals' sleep patterns have long been known to be effected by the chemical substances that are consumed during the day. Drinking coffee before bedtime often cause insomnia. The development of chemical compounds that encourage sleep has created a multi-billion dollar sleeping pill industry. It stands to reason that a device that measures an individual's varying sleep patterns may also be used to indicate whether an offender is using drugs. A device used to measure sleep patterns is called an actigraph. Usually worn on the wrist, an actigraph can learn an individual's normal sleep patterns by measuring body motion over a period of several nights. To be used as an instrument to detect possible drug use, any variations to an established sleeping pattern can be communicated to the supervising officer. Although this technique does not provide definitive evidence of drug use, it can be used to prompt the officer to require a drug test.

Conclusion

Many of the emerging technologies for drug detection can help officers make smarter decisions about the timing and frequency of traditional drug testing. This can provide significant savings to agencies. Although many of the newer technologies may not meet the scrutiny of the courts at this time, their value as a screening tool should not be overlooked. The days of using a single technology for the detection of drug use within community corrections programs are coming to a close. Agencies should carefully review all of the technologies available and select the ones that make the best fit.

Endnotes

ⁱ North Central Regional Educational Laboratory, *Correlation to Crime and Violence*, <http://www.ncrel.org/sdrs/areas/issues/envrnmnt/drugfree/sa6lk2.htm>

ⁱⁱ *ibid*

ⁱⁱⁱ Hollander, Lindsay; *Programs Aimed at Reducing Recidivism by Improving Parole Outcomes*, 2006, Issue Paper presented to the Michigan State Legislature, p.11

^{iv} Bureau of Justice Statistics - Special Report; *Substance Abuse and Treatment of Adults on Probation*, 1995, p.7, <http://www.ojp.usdoj.gov/bjs/pub/pdf/satap95.pdf>

^v Tom Mieczkowski, *Hair Analysis as a Drug Detector*, National Institute of Justice: Research in Brief, October 1997, P. 1, <http://www.ncjrs.gov/pdffiles/hair.pdf>

^{vi} Drug Testing Methodologies

^{vii} *ibid*

^{viii} O'Brien, John, *Judge calls sweat patch unreliable*, The Post Standard (Syracuse, NY), February 27, 2002, <http://www.highbeam.com/doc/1G1-83332379.html>

^{ix} Levin, Jerome, Culkin, Joseph, and Perrotto, Richard S, *Introduction to Chemical Dependency Counseling*, p. 54, Roman and Littlefield Publishing, Lanham, MD, 2001.

^x *Fuel Cell White Paper*, Intoximeters, Inc., 2008, http://www.intox.com/fuel_cell_explanation.asp

^{xi} Ver Steeg, Benjiman and Ridder, Trent, *Biomedical Optics and Medical Imaging*, OE Magazine, June/July 2005, p. 1.

^{xii} *Ibid*, p. 4.

Appendix

Information about Drug Detection Technologies

Technology	Detection Window	Relative Cost	Admissibility in Court	Manufacturers
Blood Testing	Blood is the standard other techniques will be measured against	Comparable	Yes	Numerous
Urinalysis (GC/MS)	Begins later than blood because it takes time to get to the bladder	GC/MS is the standard other techniques will be measured against	Yes	Numerous
Saliva	Comparable to blood	Higher	Yes, in most jurisdictions	Numerous
Breath Analysis	Comparable to blood	Less	Yes, in most jurisdictions	Numerous
Hair Analysis	Opens after one week and lasts until hair is cut	Higher	Yes, in most jurisdictions, but time of use is an issue	Numerous
Sweat Testing (patch)	Can detect all events while patch is worn	Comparable, but up to a month of detection is obtained	Yes, in most jurisdictions	PharmChem (TX)
Sweat Testing (continuous)	Can detect all events while bracelet is worn	Daily lease fee for a continuous system	Yes, in most jurisdictions	AMS (CO), ActSoft (FL)
NIR Absorbtion	Comparable to blood	High initial investment with low recurring costs	Untested	TruTouch Technologies (NM)
Pupilometry	Comparable to blood	Probably a daily lease arrangement – This is only used in a trial	Pre-screening use only	M CJ , Inc – EyeCheck (IL)
Actigraphy	Comparable to blood	High initial investment with low recurring costs	Pre-screening use only	SleepTime – Distributed by QuestGuard