

Scientific Underpinning

of

Preventive Medicine Associates Inc.

Toxicology Testing

Why Is Toxicology Testing Important?

Methods for urine drug testing have been available for several decades. These procedures are useful in assessing and identifying substance use in treatment programs, research program, law enforcement, the workplace, and school. Despite widespread adoption of such techniques, limited knowledge exists regarding their valid use and interpretation among many who frequently perform these tests. Obtaining a valid test result is a complex process because its results are affected by several factors, including the substance of interest, test methodology, pharmacokinetics, chain of custody procedures, and international tampering.

A number of current approaches employ urine testing as a means of determining and enhancing treatment efficacy. Regarding adolescent substance abuse treatment, urine testing is particularly salient, 95% of physicians who provide primary care to adolescents order urine drug tests.

The DSM-IV distinguishes 11 categories of use able substances, including amphetamines; cannabis; cocaine; hallucinogens; inhalant; opioids; phencyclidine (PCP); sedatives, hypnotics, and anxiolytics, alcohol; caffeine; and nicotine. Despite this many tests screen only for marijuana, cocaine, opioids, amphetamines and PCP (the NIDA five). Although these substances are the most frequently tested for, no industry standards exist. It is important to note that several substances, notably ecstasy, oxycodone, hydrocodone, buprenorphine, and clonazepam are not included in many drug screens and must be ordered separately. Thus one of the most readily remedied sources of inaccuracy in result interpretation is the use of insufficiently broad tests.

Methods of urine drug analysis fall into two general categories – screening assays and confirmatory test – although some methods of analysis are used for either purpose. Two characteristics of the test are particularly important, sensitivity and specificity refers to the lowest detectable concentration of drug whereas specificity refers to how selective an assay is for a particular drug. Ideally the standard procedure for urine drug testing should involve highly sensitive screening techniques followed by the use of highly specific confirmatory techniques for samples identified as potential positives during screening.

Many screening procedures use immunoassay techniques that rely on competition between drug chemically labeled with an enzyme, radioisotope, or flurophore and the drug present in the biological sample. The labeled drug and the sampled drug compete for binding sites on drug-specific antibodies. The ratio between the two is used the determine the presence or absence of the drug in the biological sample.

During confirmatory testing, drugs in the specimen are separated before detection. Separation is usually accomplished by using a method such as gas chromatography high performance liquid chromatography. After separation analytes reach the detector at different rates. This information provides evidence as to whether the drugs in question are present in the specimen.

Four possible outcomes exist for interpreting results: true positive, true negative, false positive, false negative. However, it is important to notes that when interpreting results, drug concentrations in the body may be lower that the designated cutoff. Thus an individual may be using drugs in such a manner that a test result may appear to be negative when drugs are in fact present. It is also important to note that the legitimate source of false positives do exist, including pseudophedrine, dextromethorphan, and poppy seeds.

One variable influencing drug detection is the cutoff threshold. Any sample having a drug concentration equal to or above a specified level is considered a positive result. This threshold may vary from context to context as well as from screen to test. Lowering the cutoff increases sensitivity although it also increases the potential for false positive results by decreasing specificity.

Some individuals may be motivated to avoid detection of their drug use. Methods for avoiding detection of substance abuse include dilution of the sample with water or other liquids, substitution with a clean or synthetic urine specimen, and adulteration with other chemicals. Several characteristics of urine may indicate whether the sample has been adulterated including pH, temperature, creatinine, specific gravity, and human immunoglobulin (IgG) levels. In a healthy volunteer, urine is expected to be 90 degrees F to 100 degrees F within several minutes of producing a sample, temperatures outside of this suggest substitution. Additionally eliminating water sources, prohibiting outer garments and personal belongings from the collection room, having subject wash their hands, and direct observation of the specimen collection are useful.

To ensure the accurate interpretation of urine drug testing it is important to consider the following topic

- Are the substances of interest included in the test? Because no standard for terms such as "routine" or "comprehensive" exist it is important to ensure that the analyses performed will detect the specific substances of interest. Requesting a category of drug is insufficient.
- Will the requested test provide the desired information? Screening procedures provide qualitative information. Whereas confirmatory testing generally provides both qualitative and quantitative information. Confirmatory testing is generally more sensitive and specific but it is also more expensive. Qualitative screening with confirmatory test for positive results typically provides the desired information although some clinical situations require quantitative information.
- Will the testing procedure detect the amount of use within the time frame of interest for a given substance? Urine testing procedures generally only detect relatively recent use. Additionally, the time frame for detection varies by substance as well as by the frequency and intensity of use. Regular and heavy use may be more easily detected, but intermittent or lighter drug use may be missed.
- Has the sample been diluted, substituted, or adulterated? These are methods used to falsify test results. Proper collection techniques, confirmation of pH, temperature, specific gravity, creatinine, and IgG levels as well as checks for adulterants, including glutaraldehyde, potassium chlorochromate, and nitrates, should be performed whenever tampering is suspected.
- Have accurate chain of custody procedures been implemented and followed? Ensuring that a specimen has not been mistakenly or intentionally switched with the specimen of another individual is fundamental to obtaining a valid result.

Jaffee, W.B., Trucco, E., Teter, C., Levy, S., and Weiss, R. (2008). Focus on Alcohol & Drug Abuse: Ensuring Validity in Urine Drug Testing. *Psychiatric Services* 59(2), 140-142.