MAYO CLINIC

REVIEW

# Clinical Interpretation of Urine Drug Tests: What Clinicians Need to Know About Urine Drug Screens

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## Abstract

Urine drug testing is frequently used in clinical, employment, educational, and legal settings and misinterpretation of test results can result in significant adverse consequences for the individual who is being tested. Advances in drug testing technology combined with a rise in the number of novel misused substances present challenges to clinicians to appropriately interpret urine drug test results. Authors searched PubMed and Google Scholar to identify published literature written in English between 1946 and 2016, using *urine drug test, screen, false-positive, false-negative, abuse,* and individual drugs of abuse as key words. Cited references were also used to identify the relevant literature. In this report, we review technical information related to detection methods of urine drug tests that are commonly used and provide an overview of false-positive/false-negative data for commonly misused substances in the following categories: cannabinoids, central nervous system (CNS) depressants, CNS stimulants, hallucinogens, designer drugs, and herbal drugs of abuse. We also present brief discussions of alcohol and tricyclic antidepressants as related to urine drug tests, for completeness. The goal of this review was to provide a useful tool for clinicians when interpreting urine drug test results and making appropriate clinical decisions on the basis of the information presented.

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There have been increased concerns regarding the nonmedical use of prescribed drugs and rising trends in illicit drug use and dependence. In 2014, it was estimated that 27 million Americans aged 12 years and older (representing 10.2% of the population) have used illicit drugs in the past month; this is compared with 7.9% in 2004.[1] Urine drug testing is routinely used in clinical practice to rule out substance-induced disorders, confirm medication adherence, and identify substances in overdose situations. Employers and courts also perform drug tests to screen for illicit drug use. Despite the widespread use of urine drug tests (UDTs), there is little published information on how to correctly interpret the results of these tests. Incorrect interpretation of test results (false-positive or false-negative) can have significant consequences (eg, loss of job and incarceration). Unfortunately, there is evidence that there is a deficiency in clinician's knowledge about accurate UDT interpretation.[2,3] Regular use of UDT did not correlate with increased knowledge; therefore, the need for clinician education may be widespread.

The goal of this review was to provide an updated guide for clinicians that includes recent reports of agents that may cause false-positive results on common UDT immunoassays. We also expanded information on marijuana on the basis of recent legislative trends and included information on synthetic cathinones and cannabinoids. Our ultimate goal was to provide a concise reference that can be used in everyday practice by clinicians to accurately interpret UDT results that lead to appropriate therapeutic decisions.

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## LITERATURE SEARCH

Authors searched PubMed and Google Scholar to identify published literature between 1946 and 2016, using the following key words: *urine drug test, screen, false-positive, false-negative,* and *abuse*. In addition, individual drugs

**ARTICLE HIGHLIGHTS**

- Immunoassays have many weaknesses that can result in false-positive and false-negative results. Understanding how to interpret urine immunoassays (eg, cutoff values, detection times, and false-positive results) is vital when ordering.
- All positive results on immunoassays need confirmatory testing (eg, gas chromatography/mass spectrometry).
- Testing for designer drugs (eg, synthetic cathinones and cannabinoids) is challenging secondary to continual changes in synthetic compounds and increasing number of novel substances.

of abuse discussed in the article were also used as key words. For completeness, we also identified relevant cited references in the initially identified publications. Publications that discussed urinary testing of substances in humans or human samples only were selected.

## METHODS OF DRUG TESTING

Drug testing can be completed on various biological specimens including urine, blood, hair, saliva, sweat, nails (toe and finger), and meconium. Urine is the most commonly obtained specimen for drug testing due to its noninvasive route and ease of sample collection. Both parent drug and metabolites may be detected in urine specimens and are usually in higher concentrations than in blood or serum samples. Drug detection times are longer in urine (ie, 1 day up to several weeks) than in blood or serum samples.[4]

There are 2 main types of UDTs, screening and confirmatory tests. Initial drug tests or screens are performed using immunoassay technology and are conducted in the laboratory or onsite with point-of-care testing (POCT). Immunoassays allow for a large number of specimen screens to be completed and provide relatively rapid results.[5] Three main types of immunoassays are available: (1) enzyme-multiplied immunoassay technique, (2) enzyme-linked immunosorbent assay (ELISA), and (3) fluorescence polarization immunoassay. In general, immunoassays use antibodies to detect the presence of drug metabolites or classes of drug metabolites in the urine. Unfortunately, immunoassays will detect substances with similar characteristics, resulting in cross-reactivity leading to false-positive results.

An increasing trend, especially in pain management clinics and with clinicians treating patients with substance use disorders, is POCT in the office setting. It allows for immediate results onsite, allowing the clinician to discuss results with the patient in real time. These POCTs should be cleared by the Food and Drug Administration (FDA) and are usually waived by Clinical Laboratory Improvement Amendments. Visual analysis of the test result provides interpretation of the outcomes. At times, results may be difficult to read (eg, faint color and uncertain color), leading to subjective interpretation.[6] In addition, POCT has the same limitations as laboratory-based immunoassays and results should be used only to screen for a substance. Consumers who purchase POCT kits are cautioned against interpreting any positive preliminary results and confirmatory testing by a professional is recommended.

All initial testing conducted with immunoassays need to be considered presumptive, and clinicians need to use clinical judgment, patient history, and collaborative information to decide whether confirmatory testing is necessary for optimal patient care. Gas chromatography/mass spectrometry (GC-MS) is considered the criterion standard in confirmatory testing and can identify specific molecular structures and quantifies the amount of a drug or substance present in the sample.[4] The GC-MS assessments must be conducted by highly trained personnel, are time-consuming and costly, and thus are reserved for confirming positive drug screens. Liquid chromatography/tandem mass spectrometry (LC-MS/MS) offers an alternative to GC-MS for confirmatory testing and may be more time-efficient. Confirmatory testing should always be conducted when making legal, forensic, academic, employment, or other decisions that have significant sequelae.

### Cutoff Levels

Cutoff values for UDT define the concentrations needed to produce positive results for immunoassays and confirmation testing on GC-MS or LC-MS/MS. Cutoff levels were established to help minimize false-positive



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