Drug Profiles, Targeted by Mass Spectrometry and Enzyme Immunoassay

Content Review: March 2023 Last Update: November 2023

Urine drug testing is useful to assess for medication compliance and/or undisclosed substance use. Although quantitative testing is available, there are several preanalytic factors, such as individual metabolism and elimination, genetics, and interactions between prescribed and/or illicit substances, that can impact the concentration of target analytes in urine and, subsequently, complicate results interpretation.[1]

In most cases, qualitative definitive testing is sufficient to determine the presence of relevant analytes, including prescription drugs, their metabolites, and illicit substances. When results are inconsistent with clinical expectations (eg, based on patient history), consultation is available to discuss results interpretation and possible secondary testing.

Featured ARUP Testing

Drug Profile, Targeted by Tandem Mass Spectrometry and Enzyme Immunoassay, Urine 2007479

Method: Qualitative Tandem Mass Spectrometry/Qualitative Enzyme Multiplied Immunoassay Technique (EMIT)/Qualitative Spectrophotometry

Drug Profile, Targeted with Interpretation by Tandem Mass Spectrometry and Enzyme Immunoassay, Urine 2009288

Method: Quantitative Tandem Mass Spectrometry/Qualitative Enzyme Multiplied Immunoassay Technique (EMIT)/Quantitative Spectrophotometry

- Use to monitor medication compliance and to detect undisclosed drug/substance use in support of pain management, substance use disorders treatment, and other pharmacotherapies involving controlled substances.
- If Drug Profile, Targeted with Interpretation (2009288) is ordered, submission of a medication history is required to optimize reporting. A faculty clinical toxicologist personally compares submitted medication information with test results to provide expert interpretation.

Test Interpretation

Sensitivity/Specificity

Analytic sensitivity: dependent on the cutoff concentrations for applicable drugs and drug classes. The concentration at which a drug or metabolite is detected varies by analyte. For a complete list of cutoff concentrations, refer to Mass Spectrometry Analysis and Immunoassay Analysis.

Mass Spectrometry Analysis

Specificity: The following list of analytes is tested by mass spectrometry, the gold-standard method for urine drug testing.

Analyte	Cutoff Concentration (ng/mL)	Additional Analyte Details
Gamma-aminobutyric Acid (GABA) Analogues		
Gabapentin (Neurontin)	3,000	—
Pregabalin (Lyrica)	3,000	—
Opioids		
6-acetylmorphine[a]	20	Metabolite of heroin
Buprenorphine (Suboxone[b], Belbuca)	5	—
Codeine[a]	40	—
Fentanyl (Duragesic)	2	—
Hydrocodone[a] (Norco, Vicodin)	40	Metabolite of codeine
Hydromorphone[a] (Dilaudid)	20	Metabolite of morphine and hydrocodone
Morphine[a] (MS Contin)	20	Metabolite of 6-acetylmorphine and codeine

[a]Refer to Opiates and Opioid Metabolism for a visual representation of the metabolic pathway for relevant opioids.

[b]Coformulation with Naloxone.

[c]Refer to Benzodiazepine Metabolism for a visual representation of the metabolic pathway for relevant sedative hypnotics.

Analyte	Cutoff Concentration (ng/mL)	Additional Analyte Details
Naloxone (Narcan)	100	—
Norbuprenorphine	20	Metabolite of buprenorphine
Norfentanyl	2	Metabolite of fentanyl
Norhydrocodone[a]	100	Metabolite of hydrocodone
Normeperidine (Demerol)	50	Metabolite of meperidine
Noroxycodone[a]	100	Metabolite of oxycodone
Noroxymorphone[a]	100	Metabolite of noroxycodone and oxymorphone; chemically identical to nornaloxone
Oxycodone[a] (Percocet)	40	—
Oxymorphone[a] (Opana)	40	Metabolite of oxycodone
Tapentadol (Nucynta)	100	—
Tapentadol-o-sulfate	200	Metabolite of tapentadol
Sedative-Hypnotics		
7-aminoclonazepam	40	Metabolite of clonazepam
Alpha-hydroxyalprazolam	20	Metabolite of alprazolam
Alpha-hydroxymidazolam	20	Metabolite of midazolam
Alprazolam (Xanax)	40	—
Clonazepam (Klonopin)	20	—
Diazepam (Valium)	50	—
Lorazepam (Ativan)	60	—
Midazolam (Versed)	20	—
Nordiazepam[c] (Nordaz)	50	Metabolite of diazepam
Oxazepam[c] (Serax)	50	Metabolite of nordiazepam and temazepam
Temazepam[c] (Restoril)	50	Metabolite of diazepam
Zolpidem (Ambien)	20	—
Zolpidem 4-phenyl carboxylic acid	100	Metabolite of zolpidem
Stimulants		
3,4-methylenedioxyamphetamine (MDA)	200	Metabolite of MDEA and MDMA
3,4-methylenedioxyethylamphetamine (MDEA, Eve)	200	—
3,4-methylenedioxymethamphetamine (MDMA, Ecstasy, Molly)	200	—
Amphetamine (Vyvanse, Adderall)	50	Metabolite of methamphetamine

[a]Refer to Opiates and Opioid Metabolism for a visual representation of the metabolic pathway for relevant opioids.

[b]Coformulation with Naloxone.

[c]Refer to Benzodiazepine Metabolism for a visual representation of the metabolic pathway for relevant sedative hypnotics.

Analyte	Cutoff Concentration (ng/mL)	Additional Analyte Details
Methamphetamine	200	—
Methylphenidate (Focalin, Ritalin)	100	—
Phentermine (Lomaira)	100	—

[a]Refer to Opiates and Opioid Metabolism for a visual representation of the metabolic pathway for relevant opioids.

[b]Coformulation with Naloxone.

[c]Refer to Benzodiazepine Metabolism for a visual representation of the metabolic pathway for relevant sedative hypnotics.

Immunoassay Analysis

Specificity: The following list of analytes is tested by immunoassay. The included immunoassays are continuously monitored and have demonstrated low false-positive rates. Note that certain analytes may cross-react with similar substances; detected cross-reacting substances cannot be distinguished by immunoassay. When cross-reactivity is a concern, or when an immunoassay result does not correlate with the patient history, secondary testing by mass spectrometry is available. Refer to the Laboratory Test Directory for specific test offerings.

Analyte(s)	Cutoff Concentrations (ng/mL)	Additional Immunoassay Details
Barbiturates	200	Targets secobarbital Cross-reacts with amobarbital, butalbital, pentobarbital, phenobarbital
Carisoprodol	100	Targets carisoprodol Cross-reacts with major active metabolite meprobamate
Cocaine	150	Targets major metabolite benzoylecgonine
Ethyl glucuronide	500	—
Methadone	150	Targets methadone Cross-reacts with major metabolite 2-ethylidene-1,5-dimethyl-3,3-diphenylpyrrolidine (EDDP)
Phencyclidine (PCP)	25	—
Tetrahydrocannabinol (THC)	20	Targets delta-9 THC metabolite Cross-reacts with delta-8 THC metabolite
Tramadol	100	Targets tramadol Cross-reacts with major metabolites O-desmethyltramadol and N-desmethyltramadol

Results

A qualitative result is provided for each analyte in the panel. **If testing with interpretation is ordered**, results will be compared with the submitted patient medication list and **a faculty clinical toxicologist will provide expert interpretation**.

Results	Reported As	Interpretive Note
Positive	Present	Indicates a specific analyte was detected above the established cutoff concentration
Negative	Not Detected	The absence of an expected drug or drug metabolite may indicate noncompliance, inappropriate timing of specimen collection relative to drug administration, poor drug absorption, diluted/adulterated urine, or limitations of testing.

Limitations

- Certain analytes tested by immunoassay may cross-react with similar substances. Refer to Immunoassay Analysis for more details.

- Detected cross-reacting substances cannot be distinguished by immunoassay.

References

1. Jannetto PJ, Bratanow NC, Clark WA, et al. Executive Summary: American Association of Clinical Chemistry laboratory medicine practice guideline - using clinical laboratory tests to monitor drug therapy in pain management patients. *J Appl Lab Med*. 2018;2(4):489-526.

Additional Resources

Yang YK, Johnson-Davis KL, Kelly BN, et al. Demand for interpretation of a urine drug testing panel reflects the changing landscape of clinical needs; opportunities for the laboratory to provide added clinical value. *J Appl Lab Med*. 2020;5(5):858-868.

Related Information

Drug Testing

ARUP Laboratories is a nonprofit enterprise of the University of Utah and its Department of Pathology. 500 Chipeta Way, Salt Lake City, UT 84108
(800) 522-2787 | (801) 583-2787 | aruplab.com | arupconsult.com