

Drug Detection Panel Testing, Meconium and Umbilical Cord Tissue

Testing biological specimens such as meconium and umbilical cord tissue to detect prenatal drug exposure is preferred to maternal self-reporting because drug use is generally underreported by pregnant individuals.¹ For example, in a recent study, 2.6% of expectant individuals reported cannabis use to their healthcare providers; however, tetrahydrocannabinol (THC) metabolite was detected in 22.4% using an umbilical cord assay.²

Testing may be indicated for neonates born with unexplained neurological complications, growth restriction, or evidence of drug withdrawal symptoms (eg, neonatal abstinence syndrome [NAS]). Testing may also be indicated if the pregnant individual has a history of high-risk behaviors (eg, drug use/misuse/abuse), has had little or no prenatal care, or has experienced unexplained placental abruption or premature labor.¹

Umbilical cord tissue testing may be preferable to meconium testing in certain contexts due to the ease and speed of collection and comparable window of detection.¹ Collecting both specimen types may increase detection of drug exposure. For a detailed discussion of newborn drug testing and the use of these specimens, refer to the [Newborn Drug Screening - Meconium and Umbilical Cord Tissue](#) topic.

Disease Overview

Timely detection of in utero drug exposure supports the identification and clinical management of affected neonates.^{1,3} The actual time window for detecting exposure is drug dependent, but results are thought to represent approximately the last trimester of a full-term pregnancy.¹

Detection of drugs is subject to the following factors¹:

- Extent of maternal drug use
- Specific drug(s) used
- Deposition of drug analytes in meconium or umbilical cord tissue, which varies based on the chemistry of the drug analyte and the unique characteristics of each specimen
- Quality of the specimen submitted for testing
- Performance characteristics of test method

Test Interpretation

Analytic Sensitivity/Specificity

- Sensitivity:
 - Detection of most compounds and metabolites is consistent between meconium and umbilical cord tissue testing, but results may not correlate with those of maternal urine testing or maternal self-report. In general, concentrations of drug analytes are lower in umbilical cord tissue than in meconium.
 - Dependent on method details and cutoff concentration for the analyte(s) of interest; cutoff concentrations have been selected to maximize agreement between meconium and umbilical cord tissue while assuring accuracy and precision requirements.
- Specificity: high; mass spectrometric methodology and inclusion of multiple drug analytes/metabolites minimizes false positives and the need for secondary testing.

Drug Class/ Drug/Drug Metabolite	Cutoff Concentrations (ng/g)	
	Drug Detection Panels, Meconium	Drug Detection Panels, Umbilical Cord Tissue ^a
Barbiturates		
Butalbital	50	25
Phenobarbital	200	75

^aUmbilical cord tissue testing for kratom alkaloids and ethanol metabolites is available separately. Associated cutoff concentrations can be found on the Laboratory Test Directory. Refer to [Related Tests](#).

^bDrug metabolite.

^cFor multidrug testing that excludes THC metabolite, refer to [Drug Detection Panel, Meconium, Qualitative \(3004583\)](#) or [Drug Detection Panel, Umbilical Cord Tissue, Qualitative \(2006621\)](#).

^dNote that delta-8 and delta-9 forms of THC metabolite cannot be distinguished in this test.

^e6-Acetylmorphine is not always detected due to the short half-life of this analyte. Typically, heroin use is associated with the presence of morphine and codeine, as well as hydrocodone and hydromorphone.

Featured ARUP Testing

[Drug Detection Panel, Meconium, Qualitative 3004583](#)

Method: Qualitative Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS)

[Drug Detection Panel and THC Metabolite, Meconium, Qualitative 3006373](#)

Method: Qualitative Tandem Mass Spectrometry

[Drug Detection Panel, Umbilical Cord Tissue, Qualitative 2006621](#)

Method: Qualitative Liquid Chromatography-Tandem Mass Spectrometry

[Drug Detection Panel and THC Metabolite, Umbilical Cord Tissue, Qualitative 3006371](#)

Method: Qualitative Liquid Chromatography-Tandem Mass Spectrometry

- Use to detect and document fetal drug exposure during the last trimester of a full-term pregnancy
- Qualitative detection of drugs and drug metabolites
- Confirmation testing usually not required due to analytical specificity (mass spectrometry)

Drug Class/ Drug/Drug Metabolite	Cutoff Concentrations (ng/g)	
	Drug Detection Panels, Meconium	Drug Detection Panels, Umbilical Cord Tissue ^a
Benzodiazepines		
Alprazolam	5	0.5
Alpha-hydroxyalprazolam ^b	5	0.5
Clonazepam	5	1
7-Aminoclonazepam ^b	5	1
Diazepam	5	1
Lorazepam	20	5
Midazolam	20	1
Alpha-hydroxymidazolam ^b	20	2
Nordiazepam	20	1
Oxazepam	20	2
Temazepam	20	1
Zolpidem	10	0.5
Cannabis		
THC metabolite ^{c,d}	5	0.2
Hallucinogens		
Phencyclidine	10	1
Kratom		
Mitragynine	25	—
Opioids and Gabapentin		
Buprenorphine	20	1
Norbuprenorphine ^b	20	0.5
Codeine	20	0.5
Dihydrocodeine	20	1
Fentanyl	10	0.5
Gabapentin	20	10
Heroin ^e	—	—
6-Acetylmorphine ^b	20	1
Hydrocodone	20	0.5

^aUmbilical cord tissue testing for kratom alkaloids and ethanol metabolites is available separately. Associated cutoff concentrations can be found on the Laboratory Test Directory. Refer to [Related Tests](#).

^bDrug metabolite.

^cFor multidrug testing that excludes THC metabolite, refer to [Drug Detection Panel, Meconium, Qualitative \(3004583\)](#) or [Drug Detection Panel, Umbilical Cord Tissue, Qualitative \(2006621\)](#).

^dNote that delta-8 and delta-9 forms of THC metabolite cannot be distinguished in this test.

^e6-Acetylmorphine is not always detected due to the short half-life of this analyte. Typically, heroin use is associated with the presence of morphine and codeine, as well as hydrocodone and hydromorphone.

Drug Class/ Drug/Drug Metabolite	Cutoff Concentrations (ng/g)	
	Drug Detection Panels, Meconium	Drug Detection Panels, Umbilical Cord Tissue ^a
Norhydrocodone ^b	20	1
Meperidine	20	2
Methadone	10	2
EDDP ^b	10	1
Morphine	20	0.5
Hydromorphone ^b	20	0.5
Naloxone	20	1
Oxycodone	20	0.5
Noroxycodone ^b	20	1
Oxymorphone	20	0.5
Noroxymorphone ^b	–	0.5
Propoxyphene	–	1
Tapentadol	20	2
Tramadol	20	2
N-desmethyltramadol ^b	20	2
O-desmethyltramadol ^b	20	2
Stimulants		
Amphetamine	20	5
Cocaine	20	0.5
Benzoylcegonine ^b	20	0.5
Cocaethylene ^b	20	1
M-hydroxy benzoylcegonine ^b	20	1
Methamphetamine	20	5
Methylenedioxyamphetamine	20	5
Methylphenidate	20	–
Phentermine	20	8

^aUmbilical cord tissue testing for kratom alkaloids and ethanol metabolites is available separately. Associated cutoff concentrations can be found on the Laboratory Test Directory. Refer to [Related Tests](#).

^bDrug metabolite.

^cFor multidrug testing that excludes THC metabolite, refer to [Drug Detection Panel, Meconium, Qualitative \(3004583\)](#) or [Drug Detection Panel, Umbilical Cord Tissue, Qualitative \(2006621\)](#).

^dNote that delta-8 and delta-9 forms of THC metabolite cannot be distinguished in this test.

^e6-Acetylmorphine is not always detected due to the short half-life of this analyte. Typically, heroin use is associated with the presence of morphine and codeine, as well as hydrocodone and hydromorphone.

Results

Results	Clinical Significance	Notes
Present	One or more drug analytes were detected	<p>Consistent with fetal exposure to relevant drug(s) prior to birth</p> <p>Does not insinuate impairment and may not affect outcomes for the infant</p> <p>May reflect drugs administered during labor and delivery</p> <p>For meconium, may reflect drugs administered directly to the newborn before specimen collection</p>
Not detected	No drug analytes were detected	<p>Only the targeted drugs can be detected</p> <p>Does not exclude the possibility that the mother used drugs during pregnancy</p>

Limitations

- The pattern and frequency of drug use by the pregnant individual cannot be determined by these tests.
- Detection of drugs in meconium or umbilical cord tissue depends on the extent of maternal drug use, as well as drug stability in matrix, the unique characteristics of drug deposition in meconium and umbilical cord tissue, the quality and quantity of specimen submitted for testing, and the performance of the test method.
- Concordance of results between twins is higher in umbilical cord tissue than in meconium.⁴
- Minimum reporting limits and estimated concentrations are established for each compound, but quantitative results are not reported.

References

1. Wabuyele SL, Colby JM, McMillin GA. [Detection of drug-exposed newborns.](#) *Ther Drug Monit.* 2018;40(2):166-185.
2. Metz TD, Silver RM, McMillin GA, et al. [Prenatal marijuana use by self-report and umbilical cord sampling in a state with marijuana legalization.](#) *Obstet Gynecol.* 2019;133(1):98-104.
3. Wu F, Jensen TL, McMillin GA. [Detection of in utero cannabis exposure in umbilical cord tissue by a sensitive liquid chromatography-tandem mass spectrometry method.](#) *Methods Mol Biol.* 2019;1872:211-222.
4. Nelson HA, Wood KE, McMillin GA, et al. [Concordance of umbilical cord drug screening in multiple births: experience from a reference laboratory and academic medical center.](#) *J Anal Toxicol.* 2022;46(6):611-618.

Related Information

[Newborn Drug Screening - Meconium and Umbilical Cord Tissue](#)
[Newborn Drug Testing Algorithm](#)

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
 Content Review May 2022 | Last Update August 2023