Urine Drug Testing Primer

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Outline

- Common drugs of abuse
- Metabolism in general
- Metabolites of specific drugs
- Drug testing
  - Samples for testing
  - Adulteration
- Example reports
- Questions
Common Drugs of Abuse

- Stimulants
  - Amphetamine, Cocaine

- Hallucinogens
  - LSD, PCP

- Depressants
  - Benzodiazepines, Barbiturates

- Analgesics
  - Morphine, Oxycodone

- Cannabinoids
  - Marijuana, Synthetic Cannabinoids

- Alcohol

Stimulants

- Symptoms
  - Increased energy
  - Euphoria
  - Reduced appetite
  - Anxiety
  - Insomnia
Hallucinogens

- Symptoms
  - Hallucinations
  - Euphoria
  - Impaired perception of reality
  - Increased heart rate and blood pressure
  - Paranoia

Depressants

- Symptoms
  - Decreased anxiety
  - Lowered inhibitions
  - Drowsiness
  - Fatigue
  - Depression
  - Impaired coordination
Analgesics

- Symptoms:
  - Pain Relief
  - Euphoria
  - Drowsiness
  - Constipation
  - Medullary Depression

Cannabinoids

- Symptoms:
  - Pain relief
  - Decreased reaction time
  - Reduced nausea and vomiting
  - Sense of relaxation
  - Increased appetite
  - Red eyes and dilated pupils
Alcohol

- Symptoms:
  - Euphoria
  - Mild stimulation
  - Lowered inhibitions
  - Reduced coordination
  - Increased risk of depression

Pharmacokinetics

- Absorption
  - Oral, IV, Inhalation, Insufflation, Transdermal, Topical, etc.

- Distribution
  - Fat- vs Water-soluble compounds
  - Blood Brain Barrier

- Metabolism
  - First Pass Metabolism
  - Phase I & Phase II Metabolism

- Excretion
  - Urine, Feces
**Metabolites of Alcohol**

\[
\begin{align*}
\text{CH}_3\text{CH}_2\text{OH} & \xrightarrow{\text{ADH}} \text{CH}_3\text{C}=\text{O} \xrightarrow{\text{ALDH}} \text{CH}_3\text{C}=\text{OH} \\
\text{Ethanol} & \quad \text{Acetaldehyde} & \quad \text{Acetate}
\end{align*}
\]

**Drug Testing**

- Basic Drug Screen Panel
  - SAMHSA 5
    - Cannabinoids, Cocaine, Amphetamine, Opiates, Phencyclidine
  - 2010 addition: ecstasy-type drugs
- Expanded Screen
What do drug screens test for?

- Parent compound

- Metabolites
  - Cannabis
    - Delta-9-tetrahydrocannabinol-9-carboxylic acid
  - Cocaine
    - Benzoylecgonine
  - Methamphetamine
    - Both methamphetamine and amphetamine
  - Heroin
    - 6-MAM, Morphine

Drug Testing

- Basic Drug Screen Panel
  - SAMHSA 5

- Types of Samples
  - Urine
  - Blood

- Unusual/special request samples
  - Saliva
  - Hair
  - Sweat
  - Tissues
<table>
<thead>
<tr>
<th>SUBSTANCE</th>
<th>BLOOD</th>
<th>SALIVA</th>
<th>SWEAT</th>
<th>URINE</th>
<th>HAIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>12 hrs</td>
<td>6-12 hrs</td>
<td>unknown</td>
<td>6-24 hrs (5 days with EtG)</td>
<td>n/a</td>
</tr>
<tr>
<td>Amphetamine</td>
<td>12 hrs</td>
<td>3 days</td>
<td>unknown</td>
<td>1-4 days</td>
<td>up to 90 days</td>
</tr>
<tr>
<td>Barbiturates</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
<td>1-21 days</td>
<td>unknown</td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
<td>1-42 days</td>
<td>unknown</td>
</tr>
<tr>
<td>Cannabis (smoked -- single use)</td>
<td>1-3 days</td>
<td>12-24 hrs</td>
<td>unknown</td>
<td>1-3 days</td>
<td>0 to 90 days</td>
</tr>
<tr>
<td>Cannabis (smoked -- regular use)</td>
<td>1-2 weeks</td>
<td>12-24 hrs</td>
<td>unknown</td>
<td>15-50 days</td>
<td>up to 90 days</td>
</tr>
<tr>
<td>Cannabis (oral-- single use)</td>
<td>2-7 days</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
</tr>
<tr>
<td>Cocaine</td>
<td>unknown</td>
<td>1 day</td>
<td>unknown</td>
<td>4-5 days</td>
<td>up to 90 days</td>
</tr>
<tr>
<td>Codeine/Morphine</td>
<td>unknown</td>
<td>12-36 hrs</td>
<td>unknown</td>
<td>2-4 days</td>
<td>up to 90 days</td>
</tr>
<tr>
<td>Heroin</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
<td>2-4 days</td>
<td>up to 90 days</td>
</tr>
<tr>
<td>MDMA (Ecstasy)</td>
<td>1 - 3 days</td>
<td>3 days</td>
<td>unknown</td>
<td>1-5 days</td>
<td>up to 90 days</td>
</tr>
<tr>
<td>Methamphetamine</td>
<td>1-3 days</td>
<td>unknown</td>
<td>unknown</td>
<td>3-5 days</td>
<td>up to 90 days</td>
</tr>
<tr>
<td>PCP</td>
<td>1-3 days</td>
<td>3 days</td>
<td>unknown</td>
<td>3-7 days</td>
<td>up to 90 days</td>
</tr>
</tbody>
</table>

http://www.erowid.org/psychoactives/testing/testing_info1.shtml

### Adulteration of Samples

- **Urine**
  - Flush drugs out of body
  - Absolute Detox XXL Drink, Ready Clean Gel Capsules, increased water intake
  - In vitro adulteration
  - Stealth, Klear, Urine Luck

- **Hair**
  - Shampoo
    - Clear Choice Hair Follicle Shampoo

- **Saliva**
  - Mouthwashes
Recognizing Adulterated Samples

- Creatinine—What is it?
  - A waste product of creatine, an amino acid contained in muscle tissue
  - Excreted in the urine
    - Level should be at least 5 mg/dL
  - Low creatinine MAY indicate diluted urine

Drug Testing Analytical Process

- Accessioning
- Screening
  - Immunoassay
  - Volatiles
  - Extraction
- Confirmation
  - Extraction
Challenges of Drug Testing

- False positives
- False negatives
- Cross-reactivity of tests
  - For example, morphine and oxycodone may produce the same test response
  - This is NOT a false positive

Levels of Impairment/Therapeutic Levels for SAMHSA 5 drugs

<table>
<thead>
<tr>
<th>SUBSTANCE</th>
<th>LEVELS OF IMPAIRMENT</th>
<th>THERAPEUTIC LEVELS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphetamines</td>
<td>10 to 2500 ng/mL</td>
<td>20-100 ng/mL</td>
</tr>
<tr>
<td>Cannabinoids</td>
<td>50-200 ng/mL, or greater</td>
<td>5-50 ng/ml</td>
</tr>
<tr>
<td>Cocaine</td>
<td>150-1000 ng/mL</td>
<td>50-300 ng/mL</td>
</tr>
<tr>
<td>Opiates</td>
<td>100-1000 ng/mL</td>
<td>10-250 ng/mL</td>
</tr>
<tr>
<td>Phencyclidine</td>
<td>0.3- 800 ng/mL, or greater</td>
<td>10-200 ng/mL</td>
</tr>
</tbody>
</table>

- Detection limits usually lower than active levels
FIRST JUDICIAL DISTRICT OF PENNSYLVANIA
INTENSIVE DRUG AND ALCOHOL UNIT
1101 VINE STREET
PHILADELPHIA, PA 19103

SAMPLE REPORT

Date: 02/25/10

<table>
<thead>
<tr>
<th>ASYMM</th>
<th>RESULT</th>
<th>UNITS</th>
<th>INTERPRETATION</th>
<th>DILUTION</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocaine</td>
<td>0.00 ng/mL</td>
<td>NEGATIVE</td>
<td>UNDILUTED</td>
<td>0.00 - 0.20</td>
<td></td>
</tr>
<tr>
<td>Opiates</td>
<td>1000.00 ng/mL</td>
<td>POSITIVE</td>
<td>UNDILUTED</td>
<td>0.00 - 200.00</td>
<td></td>
</tr>
<tr>
<td>PCP</td>
<td>7.51 ng/mL</td>
<td>NEGATIVE</td>
<td>UNDILUTED</td>
<td>0.00 - 25.00</td>
<td></td>
</tr>
<tr>
<td>Xanthenes</td>
<td>1000.00 ng/mL</td>
<td>POSITIVE</td>
<td>UNDILUTED</td>
<td>0.00 - 1000.00</td>
<td></td>
</tr>
<tr>
<td>Cannabis</td>
<td>3.10 ng/mL</td>
<td>NEGATIVE</td>
<td>UNDILUTED</td>
<td>0.00 - 25.00</td>
<td></td>
</tr>
<tr>
<td>Barbiturates</td>
<td>13.93 ng/mL</td>
<td>NEGATIVE</td>
<td>UNDILUTED</td>
<td>0.00 - 200.00</td>
<td></td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td>73.69 ng/mL</td>
<td>NEGATIVE</td>
<td>UNDILUTED</td>
<td>0.00 - 200.00</td>
<td></td>
</tr>
<tr>
<td>Etheral</td>
<td>1.50 ng/mL</td>
<td>NEGATIVE</td>
<td>UNDILUTED</td>
<td>0.00 - 25.00</td>
<td></td>
</tr>
</tbody>
</table>
Questions

- What are alternative explanations for low levels of drugs in a parent's system that don't meet the positive threshold?
- What can we say to judges when they notice our client is showing trace amounts of cocaine or some other substance in their screen?