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Analytical Testing for Marijuana

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UMASS TOX
at UMass Memorial Medical Center
Analytical Testing for Marijuana
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Disclosures

I have no actual or potential conflict of interest in relation to this program/presentation.

I provide medicolegal consultation on opioid safety
Objectives

Objective 1: To describe essential cannabis pharmacokinetics
Objective 2: To describe the potential uses and pitfalls of drug testing in OUI cases
Definitions

- Cannabis
- Marijuana
- Cannabinoids
- Delta-9-tetrahydrocannabinol (THC)
Delta-9-tetrahydrocannabinol (THC)

Delta-9-tetrahydrocannabinol $\rightarrow$

11-hydroxy-delta-9-tetrahydrocannabinol (11-OH-THC) $\rightarrow$

11-nor-9-carboxy-THC (THC-COOH)

- Inactive
- May persist in urine for weeks
Pharmacokinetics

Highly variable between individuals

Differences between smoked, vaporized, and ingested forms

Smoked marijuana: peak concentration in 3-10 minutes

Less predictable after ingestion

Chronic use causes THC deposition in fatty tissues
Testing Methods

Blood/Serum

Oral fluid

Urine
Tetrahydrocannabinol concentrations are only measurable within the first 2 h of smoking marijuana, while the psychomotor effects may last 8 h or more.

An undetectable THC concentration does not rule out driver impairment due to marijuana consumption.
Blood/serum THC

Even short delays can alter results (leading to zero-tolerance laws)

Unlike alcohol, no back extrapolation of concentrations

Serum THC concentration 7–10 ng/ml is equivalent to a blood alcohol concentration of 0.05 g/dL

Some authors recommend lowering cutoffs if alcohol also present
Evaluating THC to THC-COOH ratios (CIF)

In six volunteers, peak serum THC concentrations occurred at 8 minutes (range, 6–10 minutes) after onset of smoking, peak 11-OH-THC at 13 minutes (range, 9–23 minutes), and peak THC-COOH at 120 minutes (range, 48–240 minutes).

Approximately 1 hour after beginning to smoke a marijuana cigarette, the THC to 11-OH-THC ratio is 3:1, and the THC to THC-COOH ratio is 1:2

At approximately 2 hours, the ratios are 2.5:1 and 1:8, respectively

At 3 hours, the ratios are 2:1 and 1:16, respectively
Cannabidiol concentrations do not correlate with level of impairment
Cannabinoid glucuronide measurements
THANK YOU!

Dr. Jennifer Whitehill
Dr. Peter Friedmann
Dr. Mark Neavyn
Dr. James Carroll
The Division of Medical Toxicology at Umass

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