Marijuana Impacts: A Toxicology Perspective

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50% increase from 2007 to 2017 of drivers who have marijuana in their system.

Marijuana-related traffic deaths increased 66% since Colorado legalized recreational marijuana.
Marijuana (THC)

- Smoked
- Inhaled
- Ingested
- Vaped

- Long half-life, short duration in the blood
- THC concentrations as low as 2 ng/mL can cause impairment/effects
- Peak effects occur after peak blood concentration
- Plant has other active cannabinoids (CBD & CBN)

Cannabinoids

- Smoked
- Inhaled
- Ingested
- Vaped
Cannabinoids

- $\Delta^9$-tetrahydrocannabinol (THC)
- 11-OH-THC (Hydroxy-THC)
  - Active metabolite
- 11-nor-9-carboxy-THC (Carboxy-THC)
  - Inactive metabolite
- Cannabinol (CBN)
- Cannabidiol (CBD)
  - Promising medicinal uses
  - Depressant effects
THC Concentrations

• THC concentration in cannabis depends on:
  – Environmental conditions
  – Cultivation techniques

• Cannabis
  – Potency increasing over the years
  – 2010 Study on confiscated cannabis:
    THC 3.4% (1998) → 8.8% (2008)
  – 2012 Albania study: ~12% THC
Metabolism

• THC main metabolites
  – 11-OH-THC (Hydroxy-THC)
  – 11-nor-9-carboxy-THC (Carboxy-THC)

• Metabolized in the liver

• Lipophilic: stored in fat
  – Brain is fatty
  – Concentrations can be below detectable limits in the blood and still be active in the brain
THC in the Blood

- Dissipation from the blood is not linear
  - Back extrapolation not possible
Ingestion vs Smoked

- **Smoked**
  - Most common route of ingestion
  - Almost immediate exposure to CNS
  - Peak before smoking is finished

- **Eaten**
  - Longer time to feel effects
  - Longer time to peak in blood
  - Lower peak THC concentrations in blood
  - Prolongation of effects vs smoking
Effects

Depressant

Hallucinogen

Stimulant
Field Soberity Tests & DRE

- THC concentrations cannot be correlated to specific impairment
- Field Sobriety Tests are sensitive for THC
- Both DREs and non-DREs can sensitively determine impairment from THC
Field Soberity Tests & DRE

- No differences in cases $\geq 5$ ng VS $\leq 5$ng
- Best to use psychophysical indicators and eye exams
- Longer blood draw times yielded lower THC concentrations
- Results support the cannabis impairment training taught in DECP/DRE
Tolerance and Chronic Use

• Individuals can be impaired by THC even after there is no detectable level in the blood

• In heavy chronic users, THC can be detected in blood even after a few days of abstinence
  – Below 5 ng/ml

• Tolerance to effects of THC can occur
  – Occasional users show more impairment

• The more THC in the blood, the more likely the impairment
THC and Driving

• Driving ability is maximally impaired at elimination phase
• Decrease feeling of effects equates to less compensation and more impaired driving
• THC impairs
  – Car control
  – Increases # of obstacles hit
  – Increases deviation of lateral position
  – Impairs tracking ability
  – Increases # of sideway movements of car
  – Increases % of time spent outside of lane
## The Data

### OC Fatal Traffic Accidents

<table>
<thead>
<tr>
<th>Year</th>
<th>Case Count</th>
<th>THC</th>
<th>Cannabis Use</th>
<th>THC Only</th>
<th>Ethanol</th>
<th>At least one drug</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016 operators tested (81%)</td>
<td>101</td>
<td>21%</td>
<td>23%</td>
<td>5%</td>
<td>29%</td>
<td>50%</td>
</tr>
<tr>
<td>2017 operators tested (80%)</td>
<td>118</td>
<td>17%</td>
<td>18%</td>
<td>9%</td>
<td>32%</td>
<td>56%</td>
</tr>
<tr>
<td>2018 operators tested (76%)</td>
<td>99</td>
<td>25%</td>
<td>28%</td>
<td>11%</td>
<td>36%</td>
<td>62%</td>
</tr>
</tbody>
</table>
Impairing drugs were detected in 36% of samples where the BAC was 0.08% or greater, an increase of 5% from the previous year.
The Data

2018 OC Cannabis Demographics

- 3653 Total cases
- 3253 DUlD cases
  - 2398 positive for THC
- 82% male
- 2% 18 years old or younger
- 10% under 21 years of age
- 40% 25 years of age or younger
Per Se vs. Zero Tolerance

STATE BY STATE:
DUID ZT or Per se for Some Drugs
AS OF OCTOBER 2015

Click on a color to highlight the states in that category
- Orange: Per se limit greater than zero for some drugs
- Purple: Zero tolerance for some drugs
- Blue: Reasonable inference law with a limit greater than zero for THC

1 Pennsylvania has both a zero tolerance law for some drugs and a 1 ng per se law for THC. Pennsylvania’s 1 ng per se law is in effect a zero tolerance law.
“The highest level of a nearly 3-fold culpable accident involvement (OR:2.84, CI 1.44-5.60) was found with a THC value between 3-5 ng/mL of whole blood. Impairment produced by 2 ng/mL of THC in whole blood was equated to a 0.05% ethanol level.”

Path Forward

• No on Per Se for THC
  – GHSA, SOFT, IACP, and AAA
• Improved State Statutes on Drug Testing of Fatally Injured Drivers
  – AB 551 & SB 283
• Support for Standardization of Toxicology Testing
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