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.

Cannabinoids

- 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)

- Smoked
- Inhaled
- Ingested
- Vaped

Cannabinoids

- Δ^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

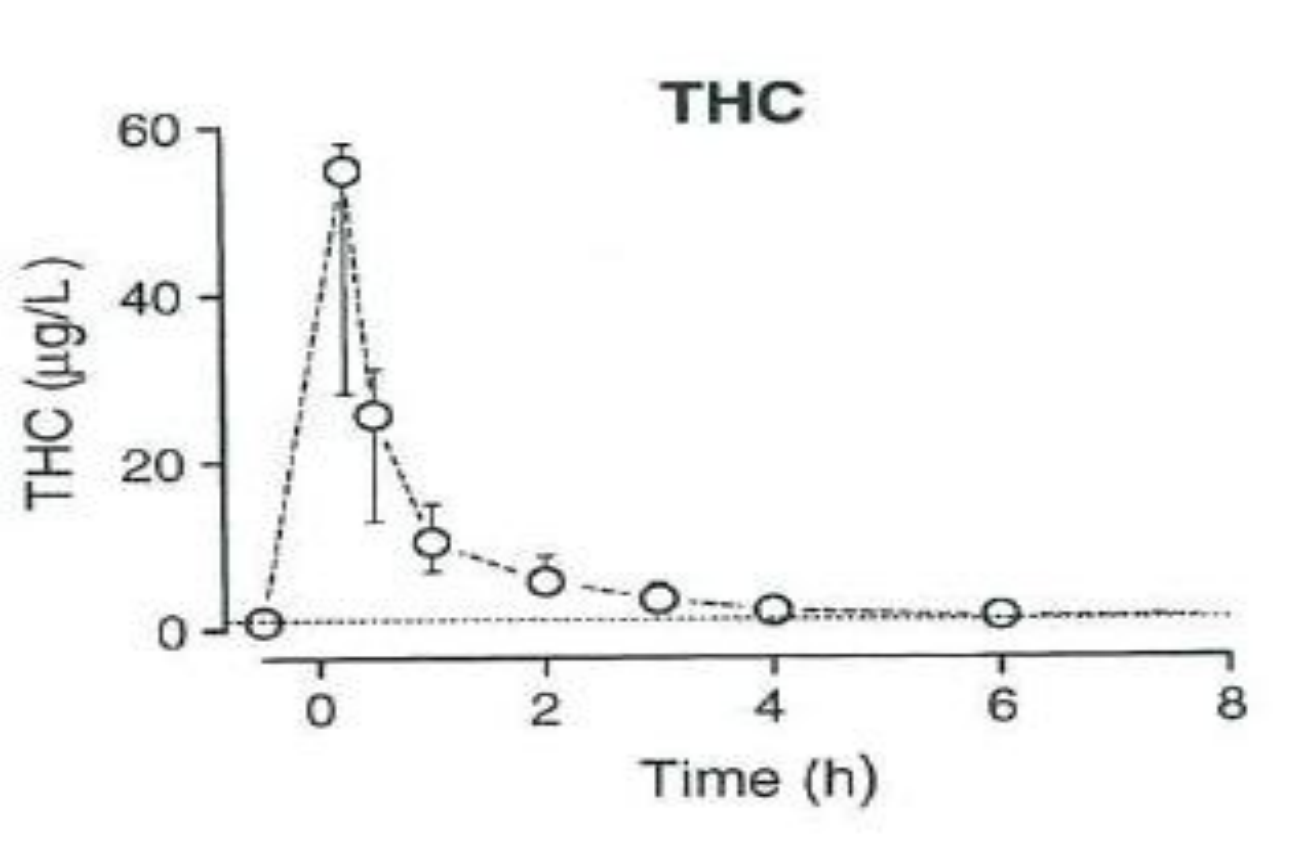
- THC concentration in cannabis depends on:
  - Environmental conditions
  - Cultivation techniques

- 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 ≥ 5 ng VS ≤ 5ng
- 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

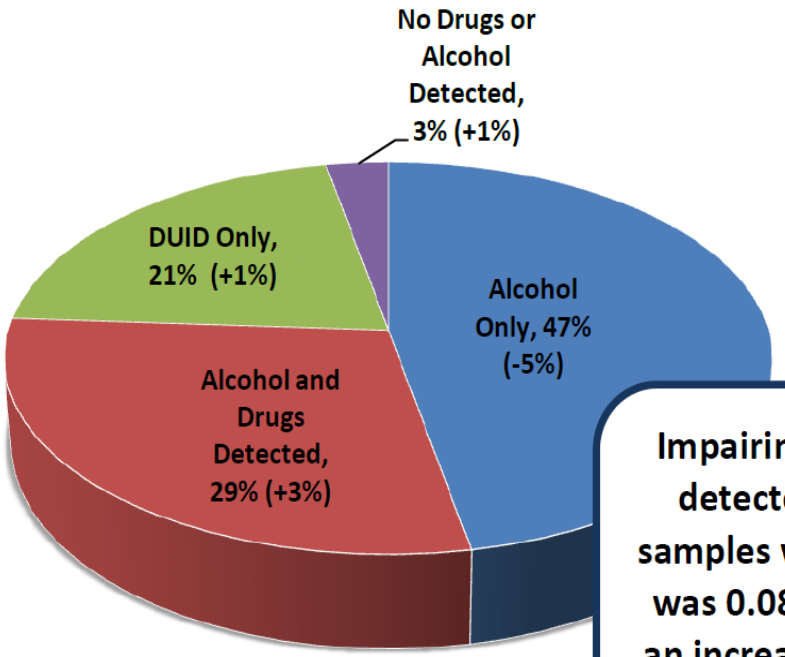
The Data

OC Fatal Traffic Accidents

Year	Case Count	THC	Cannabis Use	THC Only	Ethanol	At least one drug
2016 operators tested (81%)	101	21%	23%	5%	29%	*50%*
2017 operators tested (80%)	118	17%	18%	9%	32%	*56%*
2018 operators tested (76%)	99	25%	28%	11%	36%	*62%*

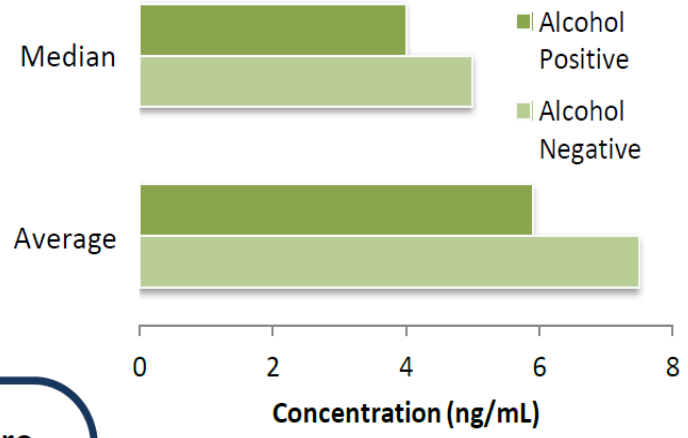
The Data - OC

DUI/DUID

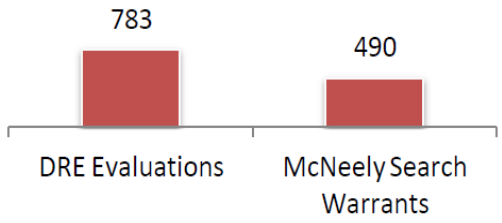


Impairing drugs were detected in 36% of samples where the BAC was 0.08% or greater, an increase of 5% from the previous year.

THC



DRE and McNeely

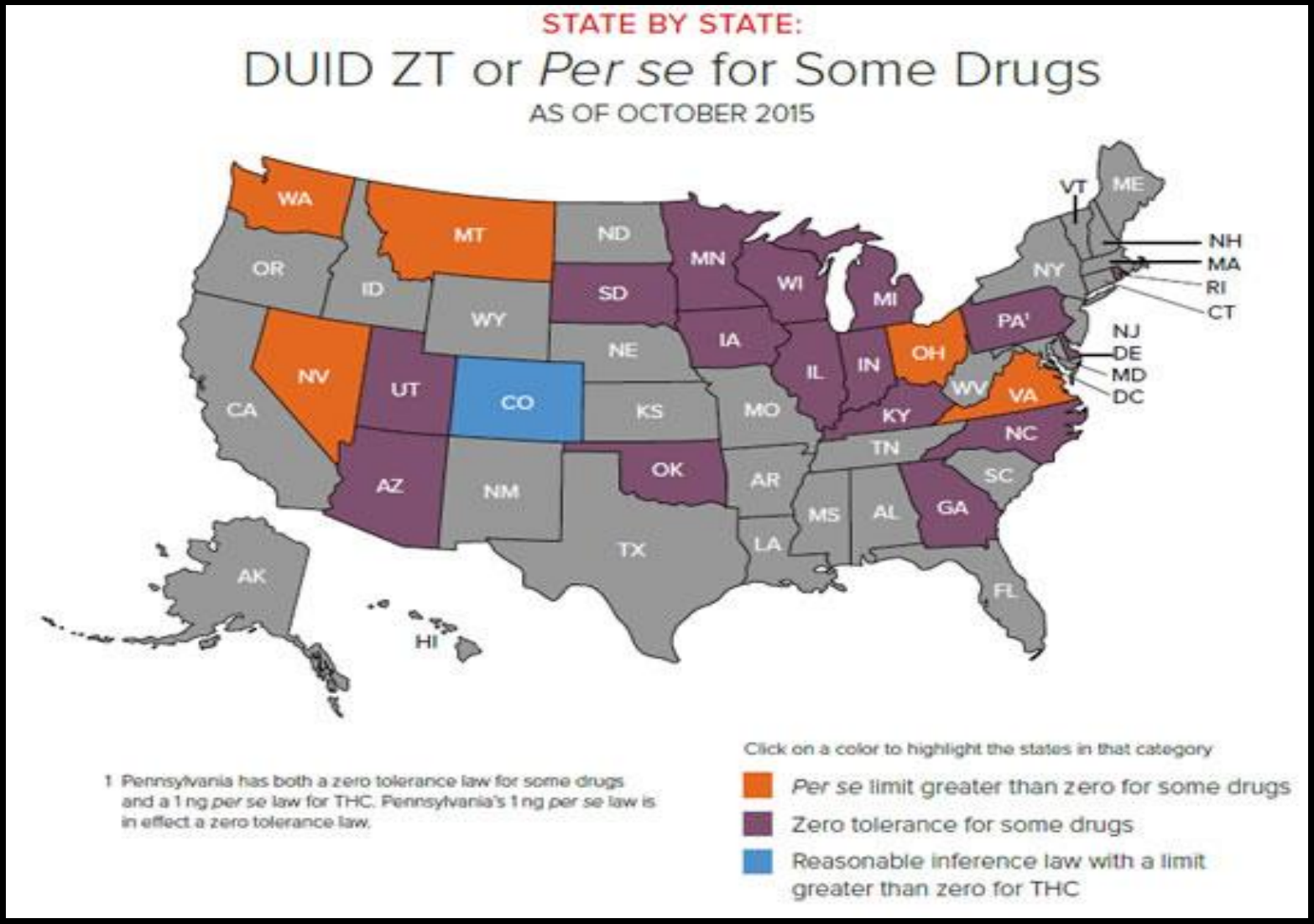


The Data

2018 OC Cannabis Demographics

- 3653 Total cases
- 3253 DUID 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



Where 5 ng/mL originated…

"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."

Knoche, A. (2013). Proceedings from International Council on Alcohol, Drugs and Traffic Safety 2013: *Per se limits – recommendations for defining cut-off values for psychoactive substance use in traffic.* Brisbane, Australia.

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

Acknowledgements

- **Orange County Crime Lab Toxicology & Controlled Substances Sections**
- Ariana Figueroa
- Matthew Nixt
- Fernando Manaloto
- Shelli Perez
- Vanessa Menses