Cannabinoid Related Mortality in Denver

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**No commercial/financial disclosures**
Cannabis Legal Status
Fatality Case #1

- March 2014
  - 19 y/o African male (Congo)
    - No significant medical history
    - No history of alcoholism, illicit drug use, or mental illness
  - Wyoming → Denver, CO (Spring Break)
  - Holiday Inn (4th floor)
  - Sales Clerk Instructions
    - Divide the cookie into 6 pieces (individual serving sizes)
    - Ingest 1 piece
Fatality Case #1

- Initially followed instructions
- 1.5 hours later, consumed remainder of cookie
- Within a few hours
  - Erratic speech
  - Hostile behavior
- 3.5 hours after initial ingestion, jumped off a hotel balcony
Fatality Case #1

• Toxicology (NMS Laboratory)
  – Chest Cavity Blood
    • Delta-9 THC ---------------------------- 7.2 ng/mL
    • Delta-9 Carboxy THC ----------------- 49 ng/mL
  – Urine
    • Cannabinoids ------------------------ Presumptive Positive (ng/mL)

• COD:  Multiple injuries due to a fall from height
• MOD:  Accident
Fatality Case #2

• April 2014
  – 44 y/o Caucasian female
  – 911 called
  – 12 minute call -- repeatedly requested assistance
    • Husband was acting strangely and “hallucinating” including “talking about the end of the world” and that “he wanted her to shoot him” which was scaring her and her three children
    • Stated husband had consumed “marijuana candy”
    • Stated there was a gun in the residence but it was kept in a safe
    • Informed dispatcher that her husband had just retrieved the gun
    • Dispatcher hears a loud shriek/scream followed by sounds of a gunshot
  – Police officers
    • Husband reportedly voluntarily confessed that he had killed his wife
Fatality Case #2

– Investigation

• Receipt for “Karma Kandy Orange Ginger” purchased a few hours prior to event
Anecdotal Accounts

- State of Colorado Marijuana Enforcement Division
  - Female in early 20’s
    - Naïve user
    - Consumed edible with 25 mg of THC
    - Rapid onset of psychosis (approximately 1 hour after consumption)
    - Suicidal thoughts (tried to get run over by a car)
    - Slowly resolved after ~ 24 hours
  - Female in mid 20’s
    - Naïve user
    - Consumed edible 12.5 mg (1/2 of Rice Krispy treat = 25 mg)
    - Rapid onset of a “drunk” feeling with inability to focus gaze and slurred speech (approximately 1 hour after consumption)
    - Tachycardia, nausea, extreme anxiety, audio hallucinations (someone yelling at her)
    - “Couch lock” -- felt trapped in her own body (tried to move arms and legs but could not)
    - Slowly resolved after ~ 24-36 hours
Edibles - 1980

Brownies
Edibles

Pop Tarts

Ice Cream

Sandwiches

Snacks
Edibles

- Olive Oil
- Canola Oil
- Butter
Edibles

Rice Crispy Treat

Chocolate Bars

Kit Kat
Serving Size
Serving Size
Serving Size
Serving Size
Smoked vs. Oral Ingestion

Approximate THC Whole Blood Concentrations after Smoked vs. Oral Administration

Cannabinoid Hyperemesis Syndrome

- Clinical presentation covered by previous speaker
- Denver Case Fatality
  - 44 YO Female found unresponsive on the floor of her bedroom by mother
  - Hx of daily cannabinoid use and hyperemesis syndrome; also gastroesophageal reflux/gastritis, pneumonia
  - Frequent episodic abdominal pain attributed to cannabinoid hyperemesis syndrome
Cannabinoid Hyperemesis Syndrome

- Autopsy Findings
  - Pneumonia/Pneumonitis on histology
  - Obese (BMI = 31.4)
- Toxicology
  11-Hydroxy Delta THC = 5.8 ng/mL
  Delta-9 Carboxy THC = 120 ng/mL
  Delta-9 THC = 13 ng/mL
  Diphenhydramine = 130 ng/mL
  Caffeine = Positive
Cannabinoid Hyperemesis Syndrome

- Vitreous Electrolytes
  Sodium = 151 mm/L
  Potassium = 6.2 mm/L
  Chloride = 129 mm/L
  Urea Nitrogen = 18 mg/dL
  Creatinine = 0.6 mg/dL
  Glucose = 64 mg/dL

* PCR of nasal washings for 20 common viral pathogens was negative*
Cannabinoid Hyperemesis Syndrome

- Other Fatal Cases Reported
  Series of 3 cases currently headed for publication
  - Histories fit the syndrome – one case initially thought to be food poisoning; another had been going through N/V cycles for 8 years
  - Electrolyte patterns vary; all had tox positive for Delta-9 THC
Cannabinoid Use and Manner of Death

- Denver Medical Examiner database query for all deaths with toxicological testing 2010 - 2016

- Toxicology positive for delta-9-THC, 11-hydroxy-delta-9-THC, and/or delta-9-carboxy-THC

- GC-MS and/or LC-MS on blood samples (preferentially peripheral); performed at a major reference laboratory

- Review of case circumstances by forensic pathologists to determine manner of death
Manner of Death

- NATURAL
- ACCIDENT
- HOMICIDE
- SUICIDE
- UNDETERMINED
Results

- 3075 postmortem examinations with toxicology ordered between 2010 - 2016

- 1682 cases occurred during the pre-legalization period (January 1, 2010 - December 31, 2013)

- 1393 cases occurred during the post-legalization period (January 1, 2014 - December 31, 2016)

- 688 (22%) were positive for the tested cannabinoids during this period
Results - Manner of Death 2010 - 2016

- Accident (non-traffic): 39.0%
- Natural: 32.0%
- Suicide: 11.0%
- Homicide: 8.0%
- Accident (traffic): 5.0%
- Undetermined: 5.0%
Results: Accidents (Non-Traffic Related)

Pre-Legalization: 87% No Cannabinoids, 13% Cannabinoids
Post-Legalization: 84% No Cannabinoids, 16% Cannabinoids

$\Delta = +3\%$
Results: Accidents (Traffic Related)

Δ = +12%
Cannabis and Driving

Figure 4. Colorado adults (18+ years) who drove a vehicle when using marijuana in the past 30 days, 2014-2015.
Results: Natural

Δ = +5%
Results: Suicide

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<thead>
<tr>
<th></th>
<th>Pre-legalization</th>
<th>Post-legalization</th>
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<tbody>
<tr>
<td>No Cannabinoids</td>
<td>87%</td>
<td>66%</td>
</tr>
<tr>
<td>Cannabinoids</td>
<td>13%</td>
<td>34%</td>
</tr>
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\[ \Delta = +21\% \]
Results: Homicide

Δ = -7%
Results: Undetermined

Δ = 0%
Summary – Manner of Death

** Correlation does not necessarily mean causation **

Our study showed the following changes in cannabinoid detection pre/post-marijuana legalization in forensic cases:

- 3% increase in accidental (non-traffic) cases
- 12% increase in accidental (traffic) cases
- 5% increase in natural cases
- 21% increase in suicide cases
- 7% decrease in homicide cases
- No change in undetermined cases

- The prevalence of Colorado adults who drove a vehicle when using marijuana in the past 30 days was not statistically different from 2014 to 2015
Final Questions

Jim Caruso, M.D.