The Blunt Truth

Exploring the Impacts of Cannabis Regulation: A Colorado Perspective

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Disclosures

- Travel & lodging accommodations by Eurad & FORUT
Objectives

1. Review the history of cannabis regulation in the United States & Colorado

2. Explore the impact of cannabis regulation on youth in Colorado
Background of Cannabis

- Relative THC concentration by preparation:
  - Marijuana: ~ 5% THC
  - Resins: ~ 20% THC
  - Oils: ≥ 60% THC

United Nations Office on Drugs & Crime (UNODC), 2009
Cannabis Regulation in the United States
## Medical Marijuana Legalization

<table>
<thead>
<tr>
<th>Year</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>California (CA)</td>
</tr>
<tr>
<td>1998</td>
<td>Alaska (AK), Oregon (OR), Washington (WA)</td>
</tr>
<tr>
<td>1999</td>
<td>Maine (ME)</td>
</tr>
<tr>
<td>2000</td>
<td>Colorado (CO), Hawaii (HI), Nevada (NV)</td>
</tr>
<tr>
<td>2004</td>
<td>Montana (MT)</td>
</tr>
<tr>
<td>2006</td>
<td>Rhode Island (RI)</td>
</tr>
<tr>
<td>2007</td>
<td>New Mexico (NM), Vermont (VT)</td>
</tr>
<tr>
<td>2008</td>
<td>Michigan (MI)</td>
</tr>
<tr>
<td>2010</td>
<td>Arizona (AZ), New Jersey (NJ)</td>
</tr>
<tr>
<td>2011</td>
<td>Delaware (DE), Washington, D.C.</td>
</tr>
<tr>
<td>2012</td>
<td>Connecticut (CT), Massachusetts (MA)</td>
</tr>
<tr>
<td>2013</td>
<td>New Hampshire (NH), Illinois (IL)</td>
</tr>
<tr>
<td>2014</td>
<td>Maryland (MD), Minnesota (MN)</td>
</tr>
</tbody>
</table>
The Story of Cannabis Regulation in the United States

Marijuana Laws in 50 States

Marijuana is now legal in some form or decriminalized in 27 states and the District of Columbia

Legal | Medicinal use only and decriminalized | Decriminalized | Medicinal use only | Illegal

Note: Federal law prohibits the possession, selling or harvesting of marijuana. Decriminalization laws reduce the penalties associated with the use or possession of small amounts of marijuana.
Sources: National Conference of State Legislatures; National Organization for the Reform of Marijuana Laws

PEW RESEARCH CENTER

Motel et al, 2015
Cannabis Regulation in Colorado
The Story of Cannabis Regulation in Colorado

- Amendment 64 (November 2012)
  - Legalized recreational cannabis (≥ 21 years of age)
  - May grow 3 immature & 3 mature plants in locked space
  - May possess up to 1 ounce cannabis in public
  - DUID: ≥ 5ng/ml

[Diagram showing timeline of events:]

- 2000: Amend. 20
- 2009: de facto Legalization
- 2010: Sen. Bill 109
- 2012

City & County of Denver: Marijuana Annual Report, 2015
The Story of Cannabis Regulation in Colorado

Let's Talk...

- 2000: Amend. 20
- 2009: De facto Legalization
- 2010: Sen. Bill 109
- 2012: Amend. 64 “Go Live”
- 2014: Today

Sources:
- www.slate.com
- www.cnn.com
- www.huffingtonpost.com
Youth Cannabis Use
Youth Cannabis Use

- Past Month (Current) Marijuana Use (2013-14), ages 12-17
  - National average: 7.22%
  - Colorado average: 12.56%
  - ↑ 20% in 2-year average post-legalization (compared to 2-year average pre-legalization)

- Colorado ranked 1st in the nation for current marijuana use
  - 74% higher than U.S. national average
  - 2012: Colorado ranked 4th (2006: 14th)
Youth Cannabis Use

Youth Ages 12 to 17 Years Old
Past Month Marijuana Use
National vs. Colorado

<table>
<thead>
<tr>
<th>Year</th>
<th>National Average</th>
<th>Colorado Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>05/06</td>
<td>6.74</td>
<td>7.60</td>
</tr>
<tr>
<td>06/07</td>
<td>6.67</td>
<td>8.15</td>
</tr>
<tr>
<td>07/08</td>
<td>6.67</td>
<td>9.13</td>
</tr>
<tr>
<td>08/09</td>
<td>7.03</td>
<td>10.17</td>
</tr>
<tr>
<td>09/10</td>
<td>7.38</td>
<td>9.91</td>
</tr>
<tr>
<td>10/11</td>
<td>7.64</td>
<td>10.72</td>
</tr>
<tr>
<td>11/12</td>
<td>7.55</td>
<td>10.47</td>
</tr>
<tr>
<td>12/13</td>
<td>7.15</td>
<td>11.16</td>
</tr>
<tr>
<td>13/14</td>
<td>7.22</td>
<td>12.56</td>
</tr>
</tbody>
</table>

SAMHSA.gov, National Survey on Drug Use and Health 2013-2014
Youth Cannabis Use

Average Past Month Use by 12 to 17 Years Old, 2013/2014

- Non-Medical Marijuana States: 5.99%
- Medical Marijuana States: 8.52%
- Recreational/Medical Marijuana States: 11.31%

SAMHSA.gov, National Survey on Drug Use and Health 2013-2014
Youth Cannabis Use

Percentage of Total Suspensions in Colorado from 2004-2014 School Years

- Commercialization
- Legalization

Academic Years:
- 2004-2005
- 2005-2006
- 2006-2007
- 2007-2008
- 2008-2009
- 2009-2010
- 2010-2011
- 2011-2012
- 2012-2013
- 2013-2014

Drug Violations:
- 1.2
- 1.3
- 1.1
- 1.0
- 1.0
- 1.0
- 1.0
- 0.9

Alcohol Violations:
- 1.2
- 1.3
- 1.1
- 1.0
- 1.0
- 1.0
- 1.0
- 0.9

Colorado Department of Education
10-Year Trend Data: State Suspension and Expulsion Incident Rates and Reasons
Youth Cannabis Use

Percentage of Total Expulsions in Colorado from 2004-2014 School Years

- Drug Violations
- Alcohol Violations

Academic Years

2004-2005: 3.4
2005-2006: 2.1
2006-2007: 2.0
2007-2008: 3.2
2008-2009: 2.1
2009-2010: 2.1
2010-2011: 2.6
2011-2012: 2.8
2012-2013: 3.0
2013-2014: 2.7

Commercialization

Legalization
Youth Cannabis Use

Percentage of Total Referrals to Law Enforcement in Colorado from 2004-2014 School Years

- Drug Violations
- Alcohol Violations

Academic Years:
- 2004-2005
- 2005-2006
- 2006-2007
- 2007-2008
- 2008-2009
- 2009-2010
- 2010-2011
- 2011-2012
- 2012-2013
- 2013-2014

Percentage of Total Referrals:
- 0
- 5
- 10
- 15
- 20
- 25
- 30
- 35
- 40

Yearly Trends:
- Commercialization
- Legalization
Young Adult Cannabis Use
Young Adult Cannabis Use

- Past Month (Current) Marijuana Use (2013-14), College Age Adults (ages 18-25)
  - National average: 19.32%
  - Colorado average: 31.24% (↑ 17% compared to 2-year average pre-legalization)

- Colorado ranked 1st in the nation for past month marijuana use
  - 62% higher than U.S. national average
  - 2012: Colorado ranked 3rd (2006: 8th)
Young Adult Cannabis Use

College Age (18 to 25 Years Old) Past Month Marijuana Use

Average Percentage

05/06 06/07 07/08 08/09 09/10 10/11 11/12 12/13 13/14

Commercialization

Legalization

National Average
16.42 16.34 16.45 17.42 18.39 18.78 18.89 18.91 19.32

Colorado Average
21.43 22.21 23.44 24.28 26.35 27.26 26.81 29.05 31.24

Annual Averages of Data Collection

SAMHSA.gov, National Survey on Drug Use and Health 2013-2014
Young Adult Cannabis Use

Average Past Month Use by 18 to 25 Years Old, 2013/2014

- Non-Medical Marijuana States: 16.43%
- Medical Marijuana States: 22.54%
- Recreational/Medical Marijuana States: 27.86%

SAMHSA.gov, National Survey on Drug Use and Health 2013-2014
Cannabis-Related Traffic Deaths
# Cannabis-Related Traffic Deaths

<table>
<thead>
<tr>
<th>Crash Year</th>
<th>Total Statewide Fatalities</th>
<th># Cannabis (+)</th>
<th>% Total Fatalities (Cannabis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>535</td>
<td>37</td>
<td>6.92%</td>
</tr>
<tr>
<td>2007</td>
<td>554</td>
<td>39</td>
<td>7.04%</td>
</tr>
<tr>
<td>2008</td>
<td>548</td>
<td>43</td>
<td>7.85%</td>
</tr>
<tr>
<td>2009</td>
<td>465</td>
<td>47</td>
<td>10.10%</td>
</tr>
<tr>
<td>2010</td>
<td>450</td>
<td>49</td>
<td>10.89%</td>
</tr>
<tr>
<td>2011</td>
<td>447</td>
<td>63</td>
<td>14.09%</td>
</tr>
<tr>
<td>2012</td>
<td>472</td>
<td>78</td>
<td>16.53%</td>
</tr>
<tr>
<td>2013</td>
<td>481</td>
<td>71</td>
<td>14.76%</td>
</tr>
<tr>
<td>2014</td>
<td>488</td>
<td>94</td>
<td>19.26%</td>
</tr>
</tbody>
</table>

National Highway Traffic Safety Administration, Fatality Analysis Reporting System (FARS), 2006-2013
CDOT/RMHIDTA 2014
Cannabis-Related Traffic Deaths

National Highway Traffic Safety Administration, Fatality Analysis Reporting System (FARS), 2006-2013
CDOT/RMHDITA 2014
Cannabis-Related Traffic Deaths

Average Number of Traffic Deaths Related to Marijuana *

Summary & Take-Home Points

• Cannabis is a harmful substance that can have serious consequences on the mind and body
• Legalization/commercialization of a substance can have profound impacts on vulnerable populations
• Prevention/Education are key & Treatment is available!
References (cont.)


Acknowledgments

- Christian Thurstone, M.D.
- Kevin Sabet, Ph.D.
Questions?

sean.lenoue@ucdenver.edu
Background of Cannabis

• History
  • Originated from central & southeast Asia
  • First noted in historical texts around 3000 B.C.

• Strains
  • Sativa, Indica, & Ruderalis

• Preparations
  • Marijuana, Kief, Hashish, Tincture, Hash Oil, & Infusions

• Consumption
  • Smoking, Vaporizing, Injecting, Teas, & Butters/Edibles

• Effects

Joy et al, 1999
Effects of Cannabis on the Body

Bodily effects of Cannabis

Eyes:
- Reddening
- Decreased intra-ocular pressure

Mouth:
- Dryness

Skin:
- Sensation of heat or cold

Heart:
- Increased heart rate

Muscles:
- Relaxation
Effects of Cannabis on the Brain

Brain Development, Appetite, Immunological Function, Reproduction, Pain Regulation/Analgesia

Adapted from Compton 2014 & www.drugabuse.gov
• ~ 33% THC crosses placenta \((\text{Gray et al}, 2005)\)

• Affects fetal oxygen delivery \((\text{Marroun et al}, 2010)\)

• Possible effects on fetal growth similar to tobacco \((\text{Marroun et al}, 2009)\)

• Endocannabanoid, immune systems, cytoskeletal dynamics (axonal connections) \((\text{Volkow et al}, 2014)\)

• Concern for consequences comparable to lead exposure \((\text{Canfield et al}, 2003; \text{CDC 2013})\)
• ↓ IQ by 5 points at age 6 (Goldschmidt et al, 2012)

• ↑ depression at age 10 (Gray et al, 2005)

• ↑ hyperactivity, impulsivity, inattention at age 10 (Goldschmidt et al, 2000)

• ↑ odds of cannabis use by age 14 & possibly heavier cannabis use later in life (Day et al, 2006)

• ↓ achievement at age 14 (Goldschmidt et al, 2012)
• Low birth weight (LBW), prematurity, poor sleep, poor self-regulation, hyper-arousal, SIDS risk

• Breastfeeding (~ 50% THC transfer)

• Case report of 13-month old admitted to hospital with lethargy, ↓ appetite, T= 38 C after 2nd hand exposure to cannabis (Zarfin et al, 2012)
• Second-hand exposure primarily

• Edibles & packaging
Inadvertent ingestion of marijuana edibles in Colorado

- Infants-12 year olds
- 15 hospital observations/admissions from 2009-2011
- NONE from 2007-2009
• 1 in 6 develop addiction

• ↓ IQ by 8 points when heavy use occurs from age 13-38

• Confers a 2-fold increased risk of psychosis in adulthood

• Daily use of cannabis predicts a doubling in odds of having an anxiety disorder at age 29

Hall and Degenhardt (2009), Lancet 374:1383-1391
Degenhardt et al. (2012), Addiction 108:124-133
Meier et al., (2012), Proc Natl Acad Sci USA 109:E2657-E2664
• Cannabis use by age 15:
  • 3.6x less likely to graduate from high school
  • 2.3x less likely to enroll in university
  • 3.7x less likely to obtain a university degree

• Cannabis before sex: 50% less likely to use a condom

• Association with aggression

• 2x ↑ risk of other drug use

Fergusson et al. (2006), Addiction 101:556-569
Hendershot et al. (2010), Psychol Addict Behav 24:404-414
Horwood et al. (2010), Drug Alcohol Dep 110:247-253
Smith et al. (2013), Drug Alcohol Depend:63-68
Adapted from Casey et al. (2008), Dev Rev 28: 62-77
Cannabis in the Media

Making marijuana into a legitimate business
10 March 2015 Last updated at 21:46 GMT
Cannabis has been legal for recreational use in the US states of Washington and Colorado for more than a year now.
Voters have also backed legalisation in Alaska and Oregon, and are facing a new challenge - how to turn an illegal drug into a legitimate business.

The New York Times
Repeal Prohibition, Again
By THE EDITORIAL BOARD
The federal government should follow the growing movement in the states and repeal the ban on marijuana for both medical and recreational use.

EDITORIAL
Let States Decide on Marijuana
By DAVID FIRESTONE
• 1 in 9-11 develop addiction

• 4x ↑ risk of MI in the hour after using

• Doubles risk of bronchitis, wheezing, & chronic cough

• May increase risk of head/neck, lung, & testicular cancers
Chronic use:
- Cognitive impairment for up to 1 month
- Psychomotor impairment for up to 3 weeks
- Decreased fertility
  - Disrupts menstrual cycle in women
  - Decreased testosterone, sperm quality/quantity in men

Hall and Degenhardt (2009), Lancet 374:1383-1391
Bosker et al. (2013), PLoS One 8:e53127
If THC > 1ng/ml:

- **2.5x** more likely to be involved in a car crash
- **3.3x** more likely to be involved in a fatal car crash

If THC ≥ 5ng/ml:

- **4.7-6.6x** more likely of being involved in a fatal car crash

Drummer et al. (2003), Forensic Sci Int 134:154-162
Laumon et al. (2005), BMJ 331:1371
Mura et al. (2003), Forensic Sci Int 133:79-85
Past Month Usage by 12 to 17 Years Old, 2013/2014

* Legalized recreational cannabis in 11/2014

** Legalized medical cannabis in 2014
* Legalized recreational cannabis in 11/2014

** Legalized medical cannabis in 2014
## Youth Cannabis Use

### States for Past Month Marijuana Use
**Youth Ages 12 to 17 Years Old, 2013/2014**

<table>
<thead>
<tr>
<th>Top 10 (Medical/Recreational States)</th>
<th>Bottom 10 (Non-Medical or Recreational States)</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Rate = 7.22%</td>
<td></td>
</tr>
<tr>
<td>1. Colorado – 12.56%</td>
<td>41. Mississippi – 5.60%</td>
</tr>
<tr>
<td>2. Vermont – 11.40%</td>
<td>42. West Virginia – 5.60%</td>
</tr>
<tr>
<td>3. Rhode Island – 10.69%</td>
<td>43. North Dakota – 5.60%</td>
</tr>
<tr>
<td>4. Oregon – 10.19%</td>
<td>44. Louisiana – 5.55%</td>
</tr>
<tr>
<td>5. Washington – 10.06%</td>
<td>45. Nebraska – 5.54%</td>
</tr>
<tr>
<td>6. Maine – 9.90%</td>
<td>46. Oklahoma – 5.52%</td>
</tr>
<tr>
<td>7. New Hampshire – 9.83%</td>
<td>47. Utah – 5.42%</td>
</tr>
<tr>
<td>9. Massachusetts – 8.88%</td>
<td>49. Iowa – 5.17%</td>
</tr>
<tr>
<td>10. California – 8.74%</td>
<td>50. Alabama – 4.98%</td>
</tr>
</tbody>
</table>
Youth Cannabis Use in Colorado

Drug-Related Suspensions/Expulsions

<table>
<thead>
<tr>
<th>Academic Years</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-2005</td>
<td>3,984</td>
</tr>
<tr>
<td>2005-2006</td>
<td>3,988</td>
</tr>
<tr>
<td>2006-2007</td>
<td>3,833</td>
</tr>
<tr>
<td>2007-2008</td>
<td>3,779</td>
</tr>
<tr>
<td>2008-2009</td>
<td>3,736</td>
</tr>
<tr>
<td>2009-2010</td>
<td>4,965</td>
</tr>
<tr>
<td>2010-2011</td>
<td>5,417</td>
</tr>
<tr>
<td>2011-2012</td>
<td>5,279</td>
</tr>
<tr>
<td>2012-2013</td>
<td>4,933</td>
</tr>
<tr>
<td>2013-2014</td>
<td>5,249</td>
</tr>
</tbody>
</table>

Commercialization and Legalization
Youth Cannabis Use in Colorado
Youth Cannabis Use

State of Colorado Probation
Average Percent Positive THC Urinalyses
Ages 12 to 17 Years

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Percent Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006-2008</td>
<td>24.15%</td>
</tr>
<tr>
<td>(Pre-Commercialization)</td>
<td>(13% Increase)</td>
</tr>
<tr>
<td>2009-2012</td>
<td>27.36%</td>
</tr>
<tr>
<td>(Post-Commercialization)</td>
<td>(20% Increase)</td>
</tr>
<tr>
<td>2013-2014</td>
<td>32.85%</td>
</tr>
<tr>
<td>(Legalization)</td>
<td></td>
</tr>
</tbody>
</table>
# Young Adult Cannabis Use

## States for Past Month Marijuana Use

**College Age Adults 18 to 25 Years Old, 2013/2014**

<table>
<thead>
<tr>
<th>Top 10 (Medical/Recreational States)</th>
<th>Bottom 10 (Non-Medical or Recreational States)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Vermont – 30.60%</td>
<td>42. Kansas – 15.11%</td>
</tr>
<tr>
<td>3. New Hampshire – 30.09%</td>
<td>43. Texas – 15.06%</td>
</tr>
<tr>
<td>4. Rhode Island – 28.90%</td>
<td>44. Alabama – 15.04%</td>
</tr>
<tr>
<td>5. Massachusetts – 28.74%</td>
<td>45. Tennessee – 14.72%</td>
</tr>
<tr>
<td>7. Oregon – 24.85%</td>
<td>47. North Dakota – 14.05%</td>
</tr>
<tr>
<td>9. Maryland – 23.42%</td>
<td>49. South Dakota – 13.02%</td>
</tr>
<tr>
<td>10. Michigan – 23.17%</td>
<td>50. Utah – 11.55%</td>
</tr>
</tbody>
</table>

National Rate = 19.32%