Presentation Roadmap

National Marijuana Policy Landscape

Limitations of Data Sources

Historical Perspectives on Substance Normalization

Comparison of Public Health Data from Colorado, Oregon, Washington, and Alaska

Colorado Public Safety Data

Environmental Impacts

Economic Impacts

Operational Impacts
National Marijuana Policy Landscape
Opinion on legalizing marijuana, 1969-2016

% who say marijuana should be made legal

Note: Don’t know responses not shown.

PEW RESEARCH CENTER
Data Limitations
Types of Data Sources

• Survey data
  • Youth Marijuana Use: Health Kids Colorado, Youth Risk Behavioral Surveillance System, Monitoring the Future, National Survey on Drug Use and Health
  • Adult Marijuana Use: Behavioral Risk Factor Surveillance System, National Survey on Drug Use and Health

• Public Health Data
  • Syndromic surveillance systems
  • Hospital and emergency department discharges
  • Poison center data
Types of Data Sources Cont.

• Public Safety Data
  • Marijuana arrests and offenses
  • Driving Under the Influence (DUI) and Driving Under the Influence of Drugs (DUID) summons
  • DUI/DUID treatment admissions
  • DUI/DUID toxicology reports
  • Fatality Analysis Reporting System (FARS)
  • Adult probationer drug test results
Survey Data Limitations

• Youth use data
  • Self-reported
  • May be given in a setting where youth do not feel they can answer freely
  • Youth that use marijuana may not be enrolled in school (applies to surveys given in school)

• Adult use data
  • Self-reported
  • Populations that use marijuana are less likely to take a survey
  • Often have small sample size issues that require aggregated years of data for reliable estimates
Public Health Data Limitations

• Hospital/emergency department discharges and poison center calls
  • Marijuana use documented through standardized coding systems intended for billing
  • Healthcare providers/Coders could be subject to surveillance bias due to increased awareness
  • Marijuana specific coding does not indicate that marijuana caused a healthcare encounter
    • It could be captured like alcohol or tobacco use
  • These data sources count events not individuals, therefore repeat offenders are possible
Public Safety Data Limitations

• Data reflect policy
  • A person intoxicated with alcohol will get a DUI regardless if impaired with marijuana (Denver)

• Data reflect resource allocation
  • The Drug Recognition Expert Force gives DUIs in Denver
  • When the DRE force doubled Denver also experienced a doubling in DUIs
What to expect based on history...
Lifting Prohibition of a Substance

• Alcohol prohibition and death rates of cirrhosis of the liver
• Lifting prohibition increased alcohol consumption and adverse health outcomes associated with alcohol

(Terris, 1967)

Figure 3—Death rates, cirrhosis of the liver, and apparent per capita consumption of absolute alcohol from spirits and wine, United States, 1900-1964
Access to a New Substance: E-cigs & Liquid Nicotine

• Increased access increased E-cig exposures reported to the poison center

(Number of Electronic Cigarette and Liquid Nicotine Exposures Reported to Poison Control Centers (NPDS))

Approximate time E-cigs and liquid nicotine became widely available

(AAPCC, 2017)
Comparison of Public Health Data

Colorado, Oregon, Washington, and Alaska
What are we seeing in legalized states?

Photo credit S. Fiala, Portland OR April 2017
Youth Marijuana Use and Prevention Indicators
## School-based surveys & legalization in states

<table>
<thead>
<tr>
<th>State, market opening &amp; survey design</th>
<th>Survey years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-market</td>
</tr>
</tbody>
</table>
| **Colorado** – markets open January 2014  
9-12<sup>th</sup> grade, *Healthy Kids Colorado Survey* | 2013 | 2015 |
| **Washington** – markets open (slowly) mid-2014  
10<sup>th</sup> grade, *Healthy Youth Survey* | 2012/2014 | 2016 |
| **Oregon** – markets open October 2015  
11<sup>th</sup> grade, *Oregon Healthy Teens* and *Student Wellness Survey* | 2013  
2014 | 2015  
2016 |
| **Alaska** – markets open October 2016  
9-12<sup>th</sup> grade, *Youth Risk Behavior Survey (YRBS)* | 2015 | n/a |
Youth Past 30 Day Marijuana Use

Monitoring the Future: 12th Grade
Oregon 11th Grade
Colorado 9th-12th Grade
Alaska YRBS 9-12th Grade
Washington 10th Grade
Monitoring the Future: 10th Grade
Youth Past 30 Day Marijuana Use: trends since legalization

Monitoring the Future: 12th Grade
Oregon 11th Grade
Colorado 9th-12th Grade
Washington 10th Grade
Monitoring the Future: 10th Grade
Combined “very” and “somewhat” easy. AK does not collect this measure. CO not significant change by year. *OR change is statistically significant. WA non-significant for state sample (shown), but significant decrease for census data.
Parent Attitudes Disapprove of Youth Marijuana Use

Combined “wrong” and “very wrong” responses to parent attitudes about the youth respondent using marijuana.

*OR change in statistically significant. Other state changes are not. AK does not have post-market data.
Combined “great” and “moderate” risk of harm. OR/WA/AK question asks about “weekly, 1-2 times per week” and CO question says “regular use”

*OR and CO changes are statistically significant. WA no significant change for 10th; AK does not have post-market data.
Perceived harm from marijuana use 1-2x/week, among youth ages 12-17

Risk increased

Data source: National Survey on Drug Use & Health (NSDUH)
Adult Marijuana Indicators
Perceived harm from marijuana use 1-2x/week, among adults age 26+

Data source: National Survey on Drug Use & Health (NSDUH)
Adult Past 30 Day Marijuana Use

Data source: State data from individual state Behavioral Risk Factor Surveillance Systems (BRFSS); U.S. data from NSDUH
Syndromic Surveillance / ESSENCE
Syndromic Surveillance / ESSENCE: Oregon and Front Range Region of Colorado

Potentially Marijuana-Related ED Visits at Participating Hospitals in Front Range Counties of CO

Rate per 1,000 ED visits

Oct-15: 6.1
Dec-15: 6.1
Jan-16: 6.1
Feb-16: 6.1
Mar-16: 4.2
Apr-16: 4.0
May-16: 5.3
Jun-16: 3.8
Jul-16: 3.8
Aug-16: 3.8
Sep-16: 3.8
Oct-16: 3.8
Nov-16: 3.8
Dec-16: 3.8
Jan-17: 3.8
Feb-17: 3.8
Mar-17: 3.8
Apr-17: 3.8
May-17: 3.8
Jun-17: 3.8
Jul-17: 3.8
Aug-17: 3.8
Sep-17: 3.8
Syndromic Surveillance / ESSENCE:
Oregon and Front Range Region of Colorado

Potentially Marijuana-Related ED Visits at Participating Hospitals in Oregon

- October 2015: Early retail sales (flower)
- June 2016: Early retail sales (edibles + extracts)
- October 2016: Marijuana retail store licensing began
- January 2017: Medical marijuana dispensaries stop selling retail marijuana
Syndromic Surveillance / ESSENCE: Oregon and Front Range Region of Colorado

- Oregon population
  - 60 out of 60 ED-receiving hospitals in all counties

- Colorado population
  - Currently have 25 out of the 27 ED-receiving hospitals in 6 front-range counties
    - Adams, Arapahoe, Boulder, Denver, Douglas, Jefferson county

- Both: hospital participation and data quality have improved over time
Syndromic Surveillance / ESSENCE: Oregon and Front Range Region of Colorado

• Query:
  • ^marij^,or ,^maraju^,or ,^thc^,or ,^cbd^,or ,^cannab^,or ,^canab^,or ,^mj^,or ,(^smok^,and, ^pot^),or,(,^smok^,and, ^weed^),or ,^hash^,or ,^hemp^ ,or,^;3043^,or,^;3052^ ,or ,^f121^,or ,^f12.1^,or ,^f122^,or ,^f12.2^,or ,^f129^,or ,^f12.9^,or ,^t407^,or ,^t40.7^

• ESSENCE search parameters:
  • Granularity: Monthly
  • Data type: Patient Location (Full Details)
  • Field: CCDD [chief complaint & discharge diagnosis]
  • Patient Class = E [in Colorado]
Rocky Mountain Poison Control
Call Data
Calls to the Rocky Mountain Poison Center from within Denver:
2001-2016
Calls to the Rocky Mountain Poison Center from within Denver: 2001-2016
Calls to the Rocky Mountain Poison Center from within Denver: 2001-2016
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Colorado Hospital Association
Discharge Data
Colorado Hospitalizations and Emergency Department Visits Indicating Marijuana

Medical Marijuana Legalized
Medical Marijuana Commercialized
Retail Marijuana Sales Began

Rate per 100,000


ED Visits
Hospitalizations

Produced by: EEOHT, CDPHE
Data Source: Colorado Hospital Association Hospital and ED Discharges 2000 (2011 for ED) to September 2015)
Colorado Hospitalizations Indicating Marijuana Compared to Other Substances

Produced by: EEOHT, CDPHE
Data Source: Colorado Hospital Association Hospital and ED Discharges 2000 (2011 for ED) to September 2015)
Colorado Emergency Visits Indicating Marijuana by Age Categories

Produced by: EEOHT, CDPHE
Data Source: Colorado Hospital Association Hospital and ED Discharges 2000 (2011 for ED) to September 2015

- **2000**
  - Prior to Legalized Medical Marijuana
  - NA

- **2001-2009**
  - Medical Marijuana Legalized
  - NA

- **2010-2013**
  - Medical Marijuana Commercialized
  - Elderly (65+): 6
  - Middle Aged (35-64): 705
  - Adults (26-34): 1,168
  - Young Adults (18-25): 1,011
  - Adolescents (9-17): 1,576
  - Children (<9): 1,055

- **2014-Sept 2015**
  - Retail Marijuana Legalized
  - Elderly (65+): 122*
  - Middle Aged (35-64): 897*
  - Adults (26-34): 1,427*
  - Young Adults (18-25): 1,893*
  - Adolescents (9-17):
  - Children (<9):

Graphs showing rates per 100,000 population.
Possible Reasons for Increases in Healthcare Encounters

- Marijuana users more comfortable going to the hosp/ED for an adverse health effect
- Patients more comfortable reporting marijuana use
- Providers are more aware of marijuana use
- Higher potency products are leading to healthcare encounters
- Naïve marijuana users
- Capturing higher marijuana use
Top ten primary diagnosis categories among emergency department visits with marijuana-related billing codes compared to those without in Colorado from 2011 through September 2015

Prevalence Ratio and 95% CI

<table>
<thead>
<tr>
<th>Diagnosis Category</th>
<th>PR</th>
<th>(95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental illness</td>
<td>5.03</td>
<td>(4.96-5.09)</td>
</tr>
<tr>
<td>Unclassified codes and E codes</td>
<td>2.09</td>
<td>(1.97-2.22)</td>
</tr>
<tr>
<td>Symptoms, signs &amp; ill-defined conditions</td>
<td>0.95</td>
<td>(0.93-0.97)</td>
</tr>
<tr>
<td>Digestive system</td>
<td>0.94</td>
<td>(0.90-0.96)</td>
</tr>
<tr>
<td>Endocrine, nutritional, metabolic &amp; immunity</td>
<td>0.84</td>
<td>(0.78-0.89)</td>
</tr>
<tr>
<td>Circulatory system</td>
<td>0.84</td>
<td>(0.80-0.86)</td>
</tr>
<tr>
<td>Nervous system &amp; sense organs</td>
<td>0.70</td>
<td>(0.68-0.72)</td>
</tr>
<tr>
<td>Musculoskeletal system &amp; connective tissue</td>
<td>0.64</td>
<td>(0.61-0.66)</td>
</tr>
<tr>
<td>Injury and poisoning</td>
<td>0.58</td>
<td>(0.57-0.59)</td>
</tr>
<tr>
<td>Genitourinary system</td>
<td>0.56</td>
<td>(0.53-0.58)</td>
</tr>
</tbody>
</table>

Produced by: EEOHT, CDPHE

Data Source: Colorado Hospital Association Hospital and ED Discharges 2000 (2011 for ED) to September 2015
Top ten primary diagnosis categories among hospitalizations with marijuana-related billing codes compared to those without in Colorado from 2000 through September 2015

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<td>9.67</td>
<td>(9.59-9.74)</td>
</tr>
<tr>
<td>Skin &amp; subcutaneous tissue</td>
<td>1.18</td>
<td>(1.11-1.25)</td>
</tr>
<tr>
<td>Nervous system &amp; sense organs</td>
<td>1.18</td>
<td>(1.13-1.23)</td>
</tr>
<tr>
<td>Injury and poisoning</td>
<td>1.16</td>
<td>(1.14-1.18)</td>
</tr>
<tr>
<td>Endocrine, nutritional, metabolic &amp; immunity</td>
<td>1.06</td>
<td>(1.02-1.10)</td>
</tr>
<tr>
<td>Infectious and parasitic diseases</td>
<td>1.01</td>
<td>(0.96-1.05)</td>
</tr>
<tr>
<td>Unclassified codes and E codes</td>
<td>0.83</td>
<td>(0.70-0.96)</td>
</tr>
<tr>
<td>Digestive system</td>
<td>0.80</td>
<td>(0.78-0.82)</td>
</tr>
<tr>
<td>Blood &amp; blood-forming organs</td>
<td>0.61</td>
<td>(0.54-0.67)</td>
</tr>
<tr>
<td>Symptoms, signs &amp; ill-defined conditions</td>
<td>0.58</td>
<td>(0.55-0.61)</td>
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Produced by: EEOHT, CDPHE
Data Source: Colorado Hospital Association Hospital and ED Discharges 2000 (2011 for ED) to September 2015
Possible Reasons for Increased Prevalence of Mental Health Conditions

- Other substance dependence is associated with marijuana use
- Mental health conditions are associated with substance use in general
- Marijuana use could be causing acute mental health conditions such as anxiety or psychosis
- ICD-10-CM should help clarify
Possible Reasons for Increases in Healthcare Encounters

• Marijuana users more comfortable going to the hosp/ED for an adverse health effect
• Patients more comfortable reporting marijuana use
• Providers are more aware of marijuana use
• Higher potency products are leading to healthcare encounters
• Naïve marijuana users
• Capturing higher marijuana use
Colorado Treatment Admissions Data
Treatment Admission Rates for Marijuana

Source: Colorado Department of Human Services, Office of Behavioral Health, Drug/Alcohol Combined Data System; Colorado Department of Local Affairs, Office of Demography.
Note: Includes admissions where marijuana is listed as the primary drug of abuse.
Treatment Admissions for Marijuana Criminal Justice Referrals

Source: Colorado Department of Human Services, Office of Behavioral Health, Drug/Alcohol Combined Data System; Colorado
Note: Includes admissions where marijuana is listed as the primary drug of abuse.
Treatment Admissions for Marijuana

Source: Colorado Department of Human Services, Office of Behavioral Health, Drug/Alcohol Combined Data System; Colorado Department of Local Affairs, Office of Demography.

Note: Includes admissions where marijuana is listed as the primary drug of abuse.
Colorado Public Safety Data
Marijuana arrest rates (per 100,000)

Source: Colorado Bureau of Investigation, National Incident-Based Crime Reporting System; Colorado Office of Demography.

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BIOTRACKTHC®
Marijuana arrest rates (per 100,000) by race

Source: Colorado Bureau of Investigation, National Incident-Based Crime Reporting System; Colorado Office of Demography.
Marijuana arrest rates (per 100,000) by age group

Source: Colorado Bureau of Investigation, National Incident-Based Crime Reporting System; Colorado Office of Demography
Marijuana arrest rates (per 100,000) by gender

Source: Colorado Bureau of Investigation, National Incident-Based Crime Reporting System; Colorado Office of Demography
Marijuana filings for serious drug crime types

Source: Colorado State Judicial Branch.
Note: County court data does not include Denver County.
DUI Citations
Colorado State Patrol

Note: Drug impairment determination is based on trooper’s informed perception and not toxicology results.
Treatment Admissions for DUI

Source: Colorado Department of Human Services, Office of Behavioral Health, Drug/Alcohol Combined Data System.

Note: Includes admissions where marijuana is listed as the primary drug of abuse.
Fatalities on Colorado Roadways

Note: A positive test for cannabinoids may be the result of active THC or one of its inactive metabolites and does not necessarily indicate impairment. Source: Data provided by Colorado Department of Transportation, 6/27/2017.

2016 DATA ARE PRELIMINARY AND SUBJECT TO CHANGE
Fatalities on Colorado Roadways

Note: A positive test for cannabinoids may be the result of active THC or one of its inactive metabolites and does not necessarily indicate impairment. Source: Data provided by Colorado Department of Transportation, 6/27/2017.

2016 DATA ARE PRELIMINARY AND SUBJECT TO CHANGE
Suspension rates (per 100,000 students)


Note: The 2016-17 school year was the first complete year where marijuana was reported separately from other drugs.
Expulsion rates (per 100,000 students)

Note: The 2016-17 school year was the first complete year where marijuana was reported separately from other drugs.
Law Enforcement Referrals in Colorado Schools 2016-17

- Other Code of Conduct Violations: 913
- Marijuana Violation: 851
- Detrimental Behavior: 676
- 3rd Degree Assaults/Disorderly: 305
- Other Drug Violations: 232
- Alcohol Violations: 156
- Disobedient/Defiant or Repeated: 152
- Dangerous Weapons: 103
- Tobacco Violations: 58
- Destruction of School Property: 43
- Other Felony: 20
- 1st, 2nd, or Vehicular Assault: 12
- Sexual Violence: 9
- Robbery: 5

Note: The 2016-17 school year was the first complete year where marijuana was reported separately from other drugs.
Environmental Impacts
2016 – MJ Industry accounts for just over 4% of total Denver electricity usage

The MJ industry accounts for 55% of Denver’s increase in electricity usage since 2012

*Data provided by Xcel Energy*
2014 - Megawatt Hours Used by Various Grow Operations

Megawatt Hours of Electricity Used

*Data provided by Xcel Energy
Marijuana Industry Water Usage

Avg water usage 0.5 to 1 gallon per plant per day for indoor cultivations

*Data provided by Denver Water*
Wastewater

Denver Wastewater monitors “loading” impacts of certain industrial industries.

“Loading” is the introduction of contaminants into the wastewater stream (soil, chemicals, pesticides, etc).

Denver Wastewater previously studied marijuana facilities and found little to no loading occurring.

*Data provided by Denver Wastewater*
Alpine Waste & Recycling

Full service waste disposal company in Denver.

The only company currently composting for the marijuana industry.

Average customer recycles and composts approximately 12% of their waste.

Average marijuana customer recycles and composts approximately 18% of their waste.
2014 Health Impact Assessment

Surveyed several of Denver’s most industrialized neighborhoods

• Odor is leading quality of life complaint
  – Headaches, nausea, eye & throat irritation
  – Reluctance to exercise, garden, socialize

• 90% of respondents say their lives would improve by reducing odors

• Marijuana businesses - 4th leading source of odor concerns

Denver’s response – adopts odor control ordinance

Odor complaints dropped by 44% in the year following the ordinance adoption.

*Data provided by the City & County of Denver
Economic Impacts
Colorado Marijuana Sales

Millions of Dollars

- Medical Sales
- Retail Sales

*Data provided by the State of Colorado
Approximately $1.3 Billion in sales in 2016

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>$306 Billion</td>
<td>$318 Billion</td>
<td>$324 Billion</td>
</tr>
<tr>
<td>MJ Sales</td>
<td>$699 Million</td>
<td>$996 Million</td>
<td>$1.3 Billion</td>
</tr>
<tr>
<td>Percent of GDP</td>
<td>0.23%</td>
<td>0.31%</td>
<td>0.40%</td>
</tr>
</tbody>
</table>

*Data provided by the State of Colorado and the US Department of Commerce*
City of Denver MJ Revenue vs Expenses

*Data provided by the City & County of Denver
Legalizations Impact on Non-Resident Tourism

- Consider visiting on a vacation:
  - More Positive: 46
  - Same: 48
  - More Negative: 6

- Consider living/working there:
  - More Positive: 38
  - Same: 51
  - More Negative: 11

- Consider buying good/services made there:
  - More Positive: 42
  - Same: 49
  - More Negative: 9

*Data sourced from a 2017 Longwoods International Survey
Colorado Cannabis Market

Direct Impact
- Retail
- Manufacturing
- Cultivation

Total Impact
- Secondary Impact
  - $996 Million
  - 9,821 jobs

- Secondary Impact
  - $1.39 Billion
  - 4,223 jobs

Total Impact
- $2.39 Billion
- 14,044 jobs
Operational Impacts
Denver currently has 1133 active marijuana business licenses operating out of 491 unique locations.

That’s 39% of the state’s licenses. Denver is home to 13% of the state’s population.

*Data provided by the City & County of Denver
Denver - Number of Active Marijuana Business Licenses By Month

Denver - Number of Unique Marijuana Business License Locations
Marijuana Licensing Applications

- New Apps
- Renewal
- Transfer of Location
- Transfer of Ownership
- Modification of Premises
- Corporate Structure Changes

*Data provided by the City & County of Denver

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MARIJUANA INSPECTIONS BY DEPT

<table>
<thead>
<tr>
<th>Year</th>
<th>CPD Building</th>
<th>CPD Zoning</th>
<th>DEH EQ</th>
<th>DEH PHI</th>
<th>DFD</th>
<th>EXL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>557</td>
<td>1007</td>
<td>685</td>
<td>230</td>
<td>614</td>
<td>2875</td>
</tr>
<tr>
<td>2015</td>
<td>641</td>
<td>1887</td>
<td>947</td>
<td>305</td>
<td>515</td>
<td>3798</td>
</tr>
<tr>
<td>2016</td>
<td>1411</td>
<td>1296</td>
<td>920</td>
<td>483</td>
<td>252</td>
<td>2313</td>
</tr>
<tr>
<td>2017</td>
<td>703</td>
<td>1048</td>
<td>708</td>
<td>510</td>
<td>104</td>
<td>1006</td>
</tr>
</tbody>
</table>

*Data provided by the City & County of Denver*
Average Time to Inspect (approximations)

- CPD Building: 50 minutes
- CPD Zoning: 120 minutes
- DEH EQ: 90 minutes
- DEH PHI: 60 minutes
- DFD: 150 minutes
- EXL: 55 minutes
- TOTAL 8.75 inspecting hours for license sign off with NO reinspections

*Data provided by the City & County of Denver*
Denver has hired 58 FTEs specifically to handle regulation of the industry

*Data provided by the City & County of Denver
Average Number of Violations Noted per Food Safety Compliance Inspection (excluding investigations)