Exploring the Social, Legal, and Neurodevelopmental Impacts of Cannabis Use: A Colorado Perspective

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Denver Health
Level One Care for ALL

Children's Hospital Colorado

Disclosures

- European Cities Against Drugs (ECAD) Travel & Lodging stipend

Objectives

1. Review history & background of cannabis

2. Assess the effects of cannabis use on the body & mind from a neurodevelopmental perspective

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

4. Explore the impact on academic performance of youth using cannabis in Colorado

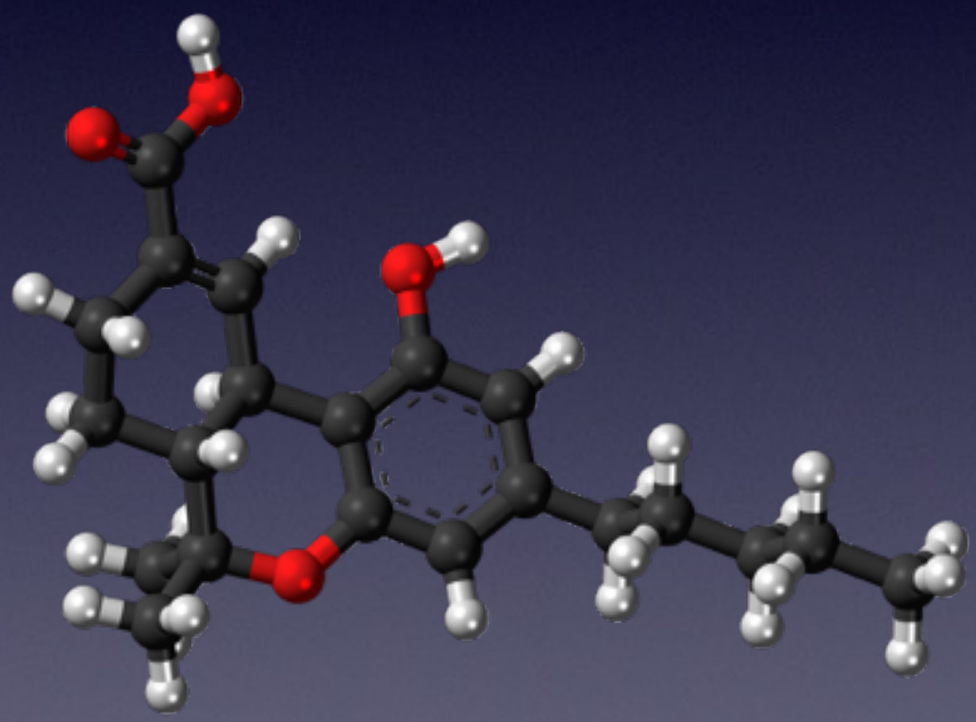
5. Review evidence-based treatment modalities for substance use disorders

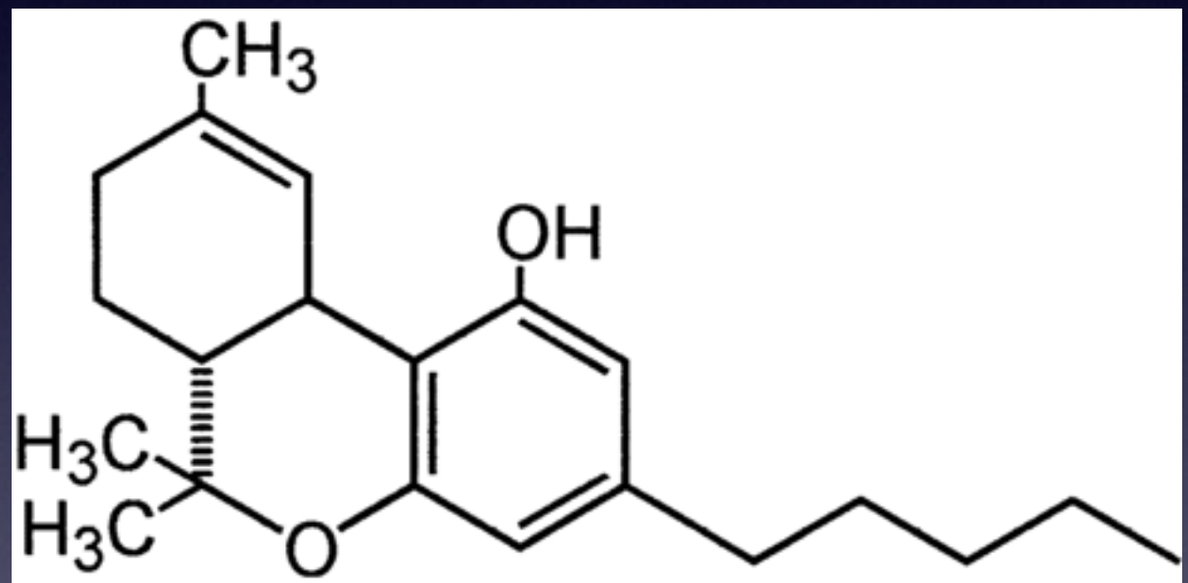
Background of Cannabis

- 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

Background of Cannabis



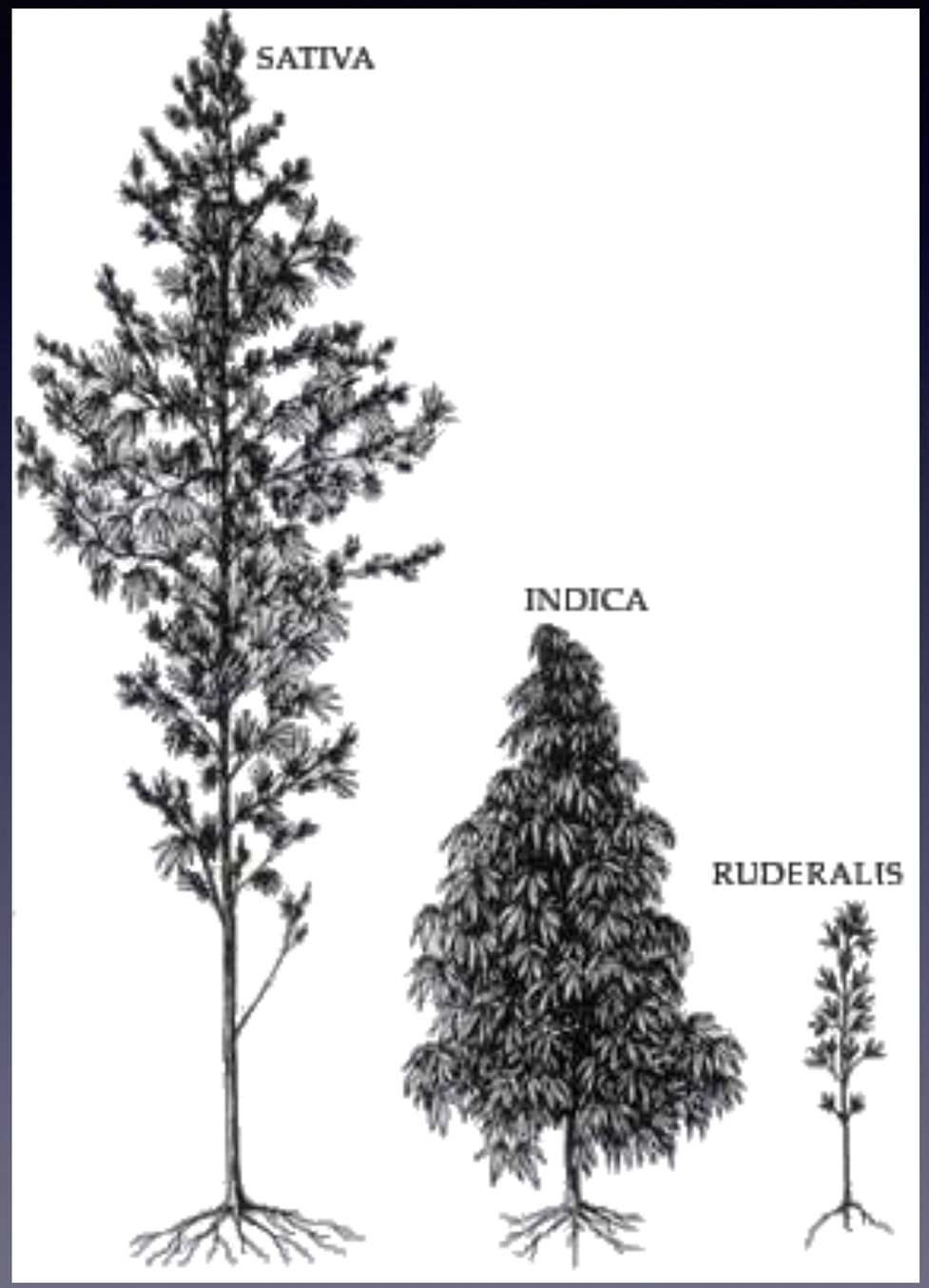


Δ-9-tetrahydrocannabinol (THC)

www.erowid.org

Background of Cannabis

- Strains
  - *Sativa*
    - THC > CBD
    - Energizing
    - Euphoria
    - Mind > Body
  - *Indica*
    - CBD > THC
    - Sedating
    - “Body Melt”
    - Body > Mind
  - *Ruderalis*
    - Hybridization



Joy et al, 1999

Background of Cannabis

- Strains
  - ***Sativa***
    - **THC > CBD**
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Joy et al, 1999

Background of Cannabis

- Strains
  - *Sativa*
    - THC > CBD
    - Energizing
    - Euphoria
    - Mind > Body
  - ***Indica***
    - **CBD > THC**
    - **Sedating**
    - **“Body Melt”**
    - **Body > Mind**
  - *Ruderalis*
    - Hybridization

Joy et al, 1999

Background of Cannabis

- Strains
  - *Sativa*
    - THC > CBD
    - Energizing
    - Euphoria
    - Mind > Body
  - *Indica*
    - CBD > THC
    - Sedating
    - “Body Melt”
    - Body > Mind
  - ***Ruderalis***
    - **Hybridization**

Joy et al, 1999

Background of Cannabis

- Preparations
  - **Marijuana**
  - Kief
  - Hashish
  - Tincture
  - Infusions

www.thesmokingbud.com

Background of Cannabis

- Preparations
  - Marijuana
  - **Kief**
  - Hashish
  - Tincture
  - Infusions

Background of Cannabis

- Preparations
  - Marijuana
  - Kief
  - **Hashish**
    - Oil
    - Shatter
    - Dabs
    - Wax
  - Tincture
  - Infusions

www.flikr.com

Background of Cannabis

- Preparations
  - Marijuana
  - Kief
  - **Hashish**
  - **Oil**
  - Shatter
  - Dabs
  - Wax
- Tincture
- Infusions

www.wired.com

Background of Cannabis

- Preparations
  - Marijuana
  - Kief
  - **Hashish**
    - Oil
    - **Shatter**
    - Dabs
    - Wax
  - Tincture
  - Infusions

www.slate.com

Background of Cannabis

- Preparations
  - Marijuana
  - Kief
  - **Hashish**
    - Oil
    - Shatter
    - **Dabs**
    - Wax
  - Tincture
  - Infusions

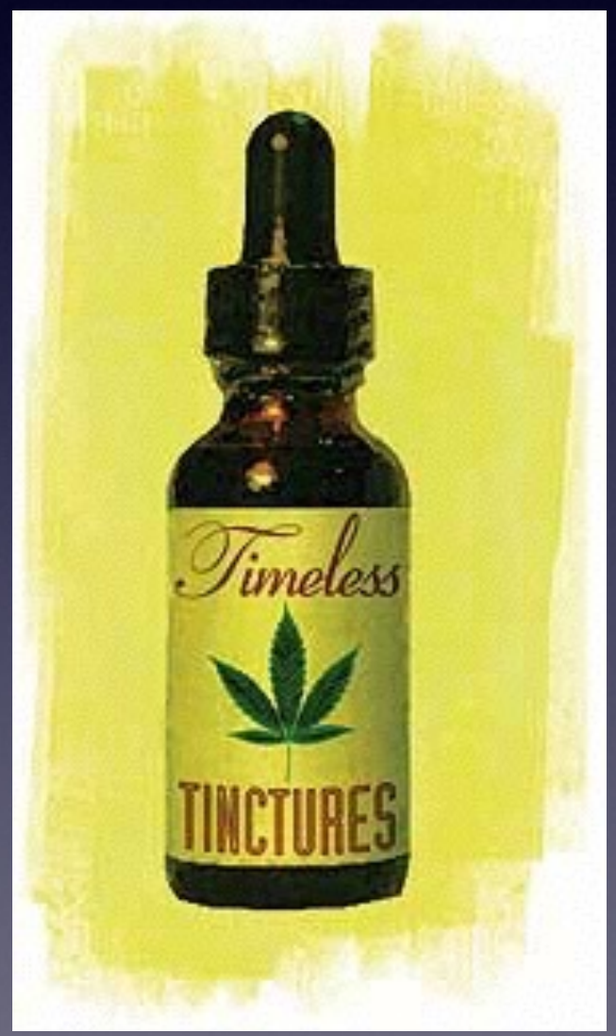
Background of Cannabis

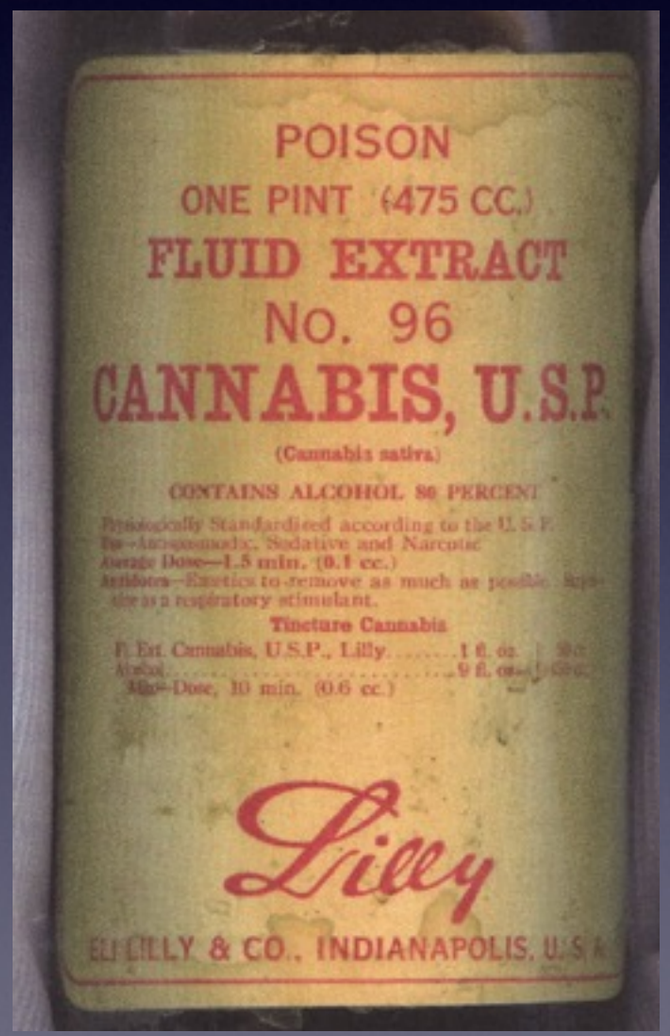
- Preparations
  - Marijuana
  - Kief
  - **Hashish**
    - Oil
    - Shatter
    - Dabs
    - **Wax**
  - Tincture
  - Infusions

www.rollingstone.com

Background of Cannabis

- Preparations
  - Marijuana
  - Kief
  - Hashish
  - **Tincture**
  - Infusions





www.lilly.com

Background of Cannabis

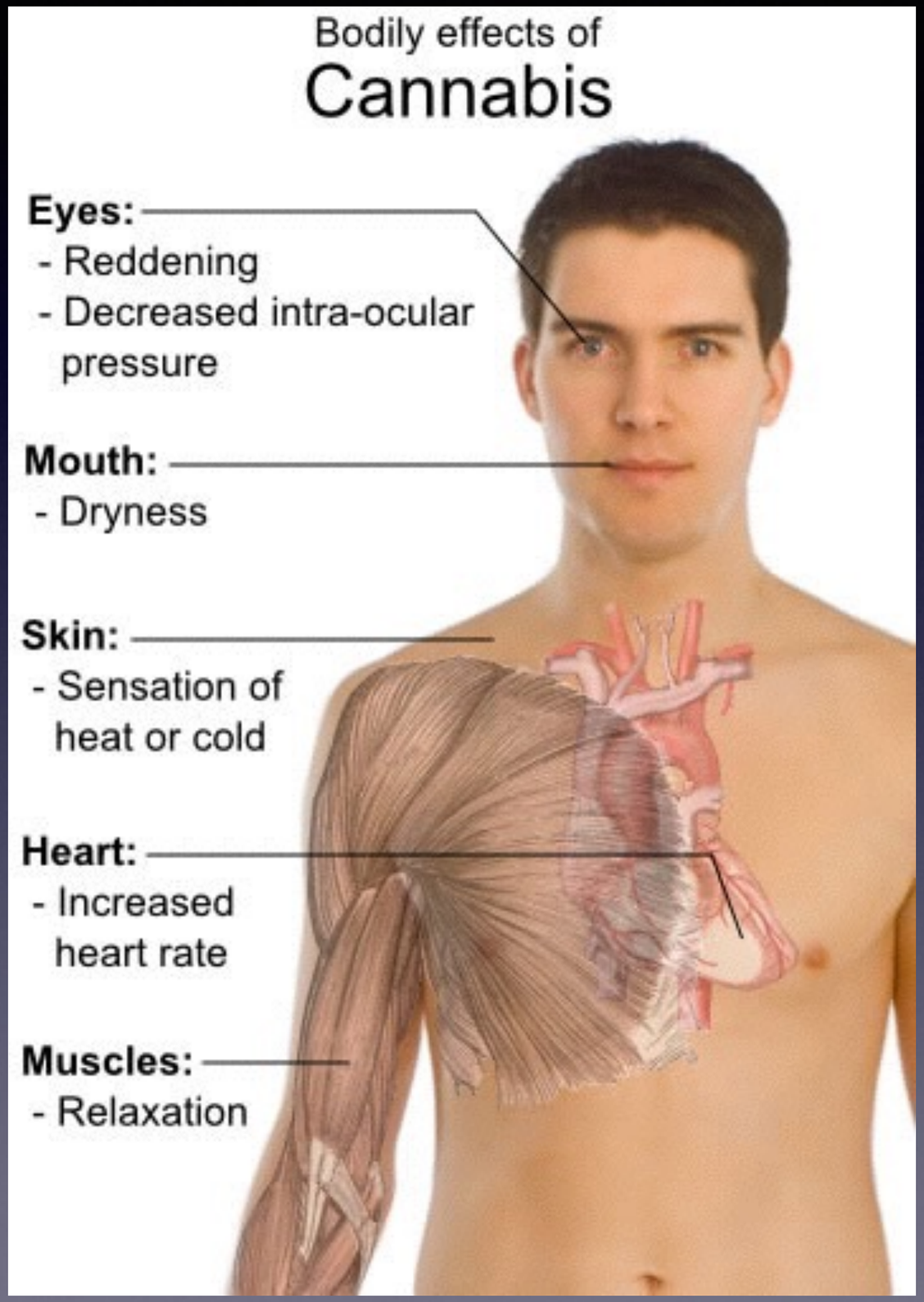
- Preparations
  - Marijuana
  - Kief
  - Hashish
  - Tincture
  - **Infusions**
    - **Butters**

Background of Cannabis

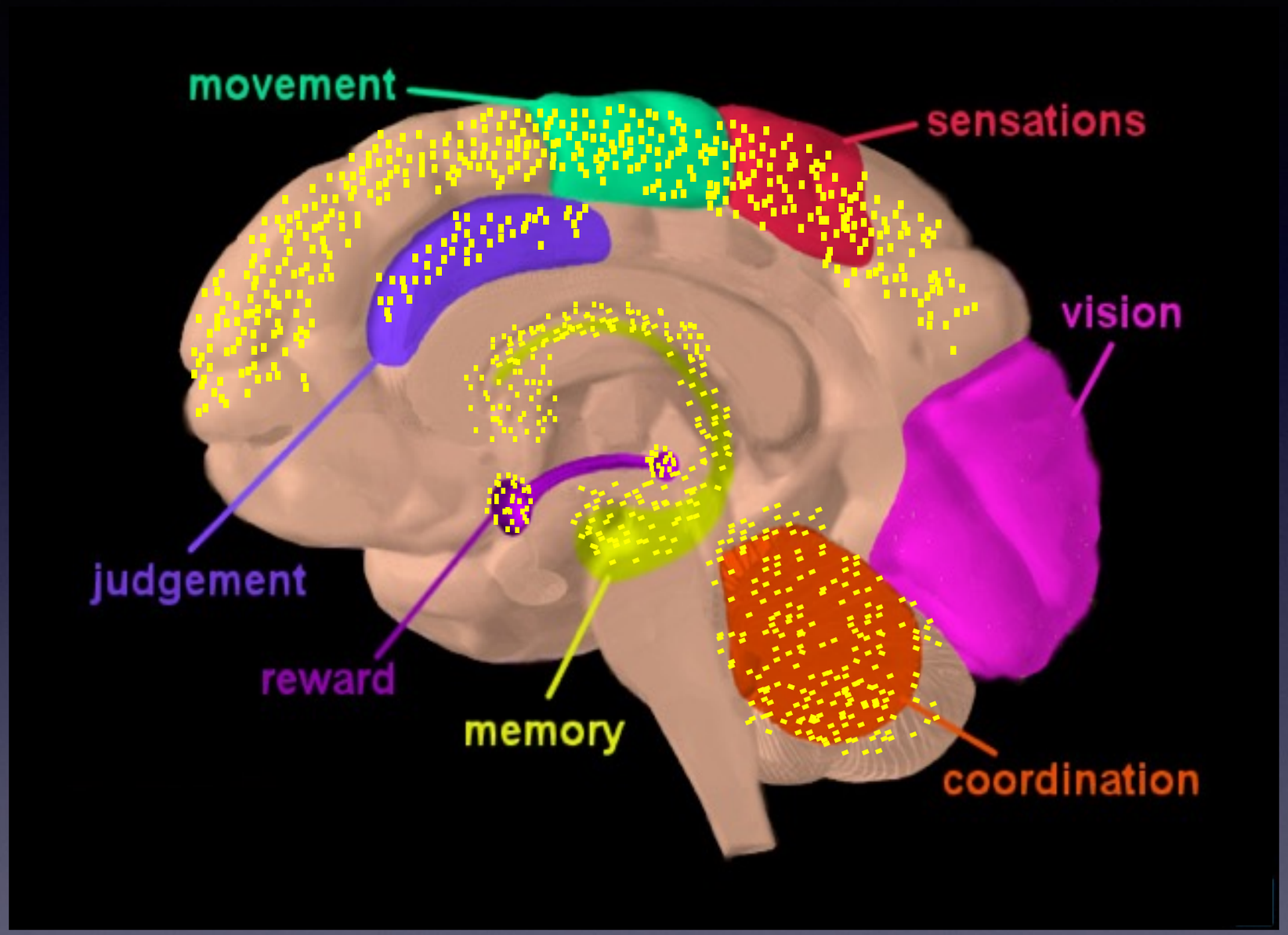
- Relative THC concentration by preparation
  - Marijuana: ~ 5% THC
  - Resins: ~ 20% THC
  - Oils: ≥ 60% THC

United Nations Office on Drugs & Crime (UNODC), 2009

Effects of Cannabis on the Body

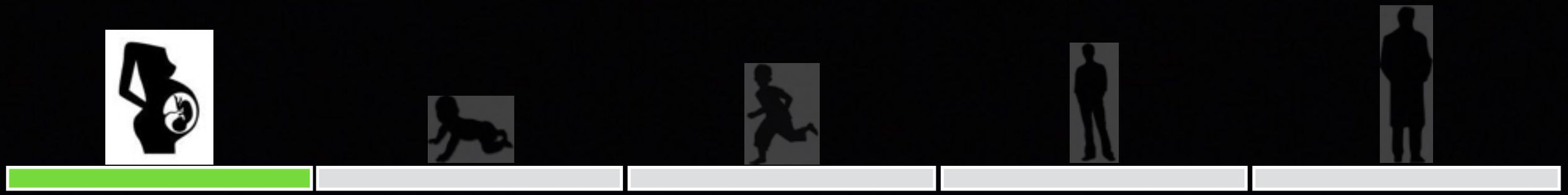


Effects of Cannabis on the Brain



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

Adapted from Compton 2014 & www.drugabuse.gov



- ~ 33% THC crosses placenta (Gray et al, 2005)
- Affects fetal oxygen delivery (Marroun et al, 2010)
- Possible effects on fetal growth similar to tobacco (Marroun et al, 2009)
- Endocannabanoid, immune systems, cytoskeletal dynamics (axonal connections) (Volkow et al, 2014)
- Concern for consequences comparable to lead exposure (Canfield et al, 2003; CDC 2013)

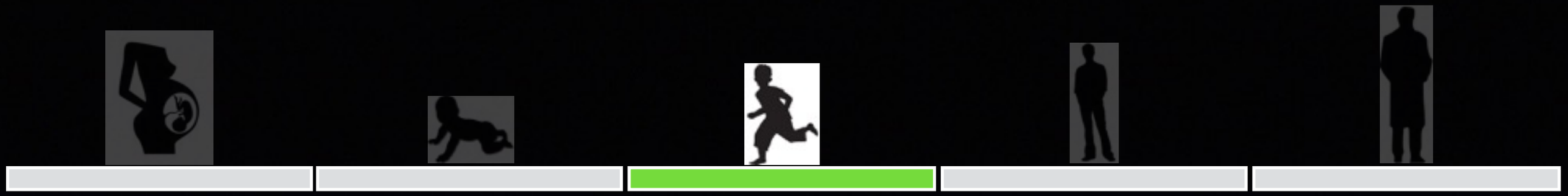
- ↓ IQ by 5 points at age 6 (Goldschmidt et al, 2012)
- ↑ depression at age 10 (Gray et al, 2005)
- ↑ hyperactivity, impulsivity, inattention at age 10 (Goldschmidt et al, 2000)
- ↑ odds of cannabis use by age 14 & possibly heavier cannabis use later in life (Day et al, 2006)
- ↓ achievement at age 14 (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)

Gray et al, 2005
Marroun et al, 2010



- 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

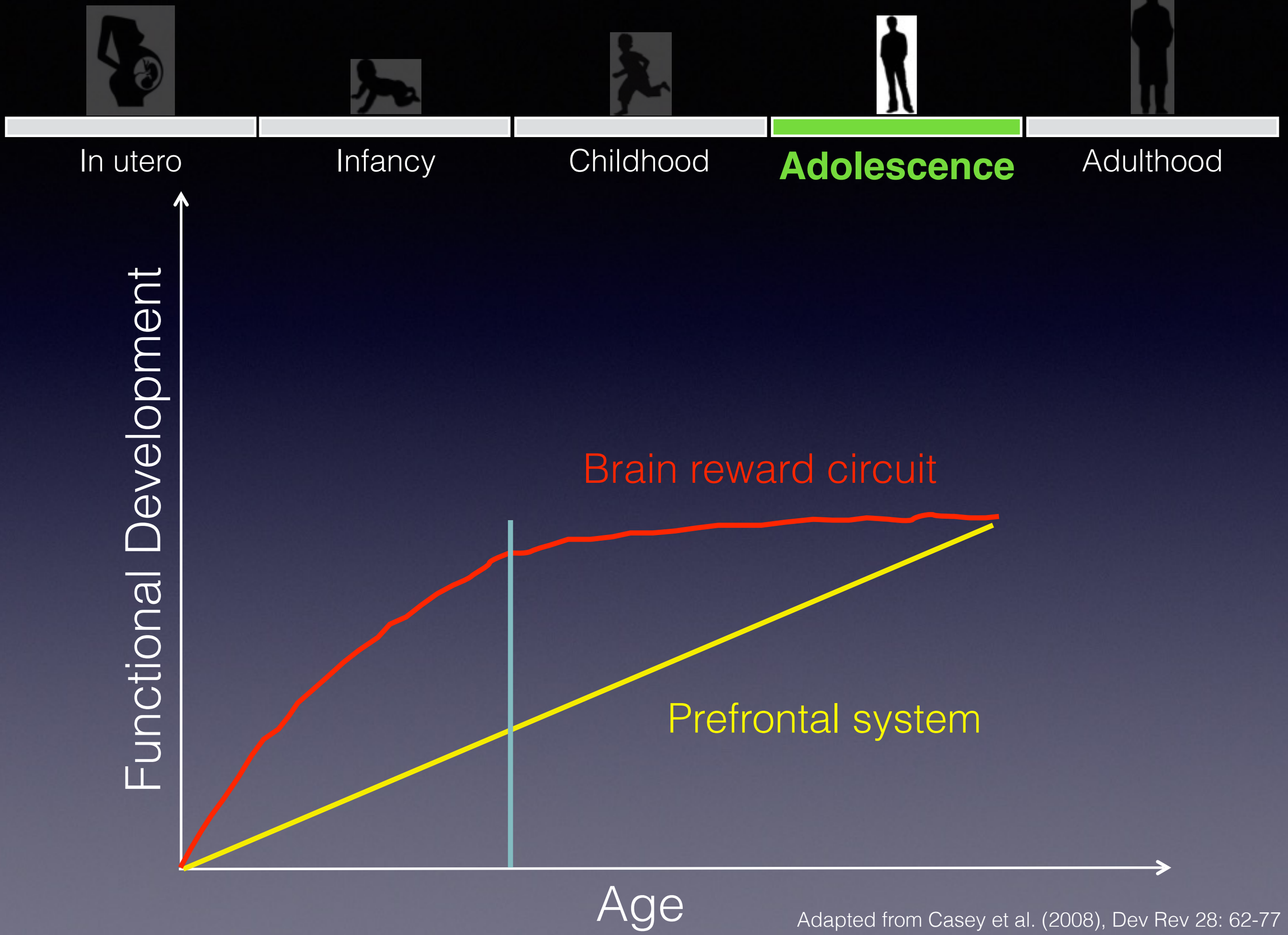
Wang et al, 2013

- 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


MedicalJane


TOP
PREMIUM CIGARETTE ROLLING MACHINE
HI-LITER
HI-LITER
HI-LITER
JOB


vaporizer-info.com

Consider the Developing Mind of a Child or Adolescent

- 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

Lacson et al. (2012), Cancer 118:5734-5783
Hall and Degenhardt (2013), Drug Testing and Analysis
Mittleman et al. (2001), Circulation 103:2805-2809

Hall and Degenhardt (2009), Lancet 374:1383-1391
Pope et al., (2002), J Clin Pharmacol 42:41S-47S
Bosker et al. (2013), PLoS One 8:e53127

- 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

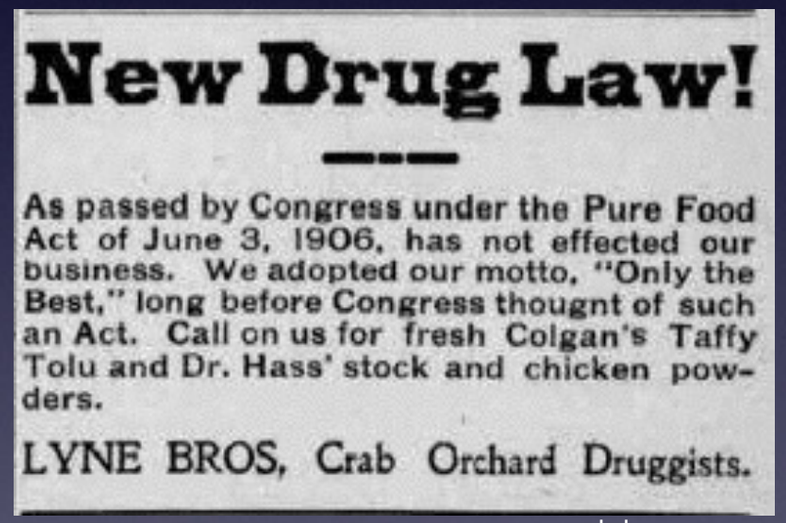
- If THC > 1ng/ml:
  - **2.5x** more likely to be involved in a car crash
  - **3.3x** more likely to be involved in a fatal car crash
- If THC ≥ 5ng/ml:
  - **4.7-6.6x** more likely of being involved in a fatal car crash

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

The Story of Cannabis Regulation in the United States

The Story of Cannabis Regulation in the United States

- Pure Food & Drug Act (1906)
  - Required special drugs, including cannabis, to be accurately labeled with contents
  - Restricted sales of narcotics, including cannabis, to pharmacies with physician's prescription
  - Cannabis remains **legal** in the United States



New Drug Law!

As passed by Congress under the Pure Food Act of June 3, 1906, has not effected our business. We adopted our motto, "Only the Best," long before Congress thougnt of such an Act. Call on us for fresh Colgan's Taffy Tolu and Dr. Hass' stock and chicken powders.

LYNE BROS, Crab Orchard Druggists.

www.weebly.com

1906

Pure Food and Drug Act (1906). United States. United States Statutes at Large (59th Cong., Sess. I, Chp. 3915, p. 768-772; cited as 34 U.S. Stats. 768)

The Story of Cannabis Regulation in the United States

- International Opium Convention (1925)
  - Banned exportation of Indian hemp (hashish) & derivatives to countries prohibiting its use
  - Required importing countries to issues certificates approving importation
  - Cannabis remains **legal** in the United States

UNODC, www.unodc.org

The Story of Cannabis Regulation in the United States

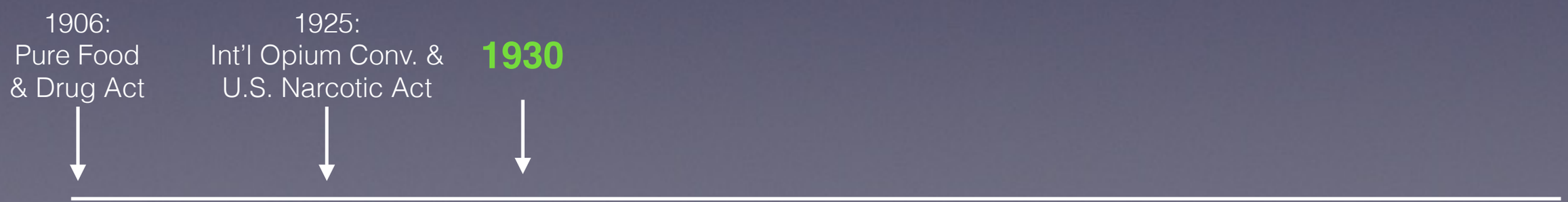
- Uniform State Narcotic Act (1925)
    - Aimed to provide uniform monitoring & regulation of narcotics in all states.

- Cannabis remains **legal** in the United States

Frontline, www.pbs.org

The Story of Cannabis Regulation in the United States

- Federal Bureau of Narcotics (1930)
  - Federal Bureau of Narcotics founded to provide greater oversight, regulation of cannabis & other controlled substances
  - Cannabis remains **legal** in the United States



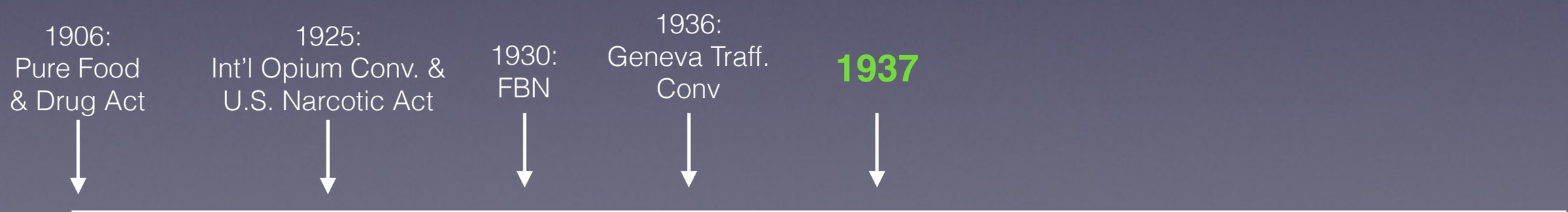
FBN, www.dea.gov

The Story of Cannabis Regulation in the United States

- The 1936 Geneva Trafficking Conventions
  - Aimed to criminalize the “cultivation, production, manufacture and distribution of opium, coca, & cannabis” for non-medical/non-scientific purposes.
  - Cannabis remains **legal** in the United States

The Story of Cannabis Regulation in the United States

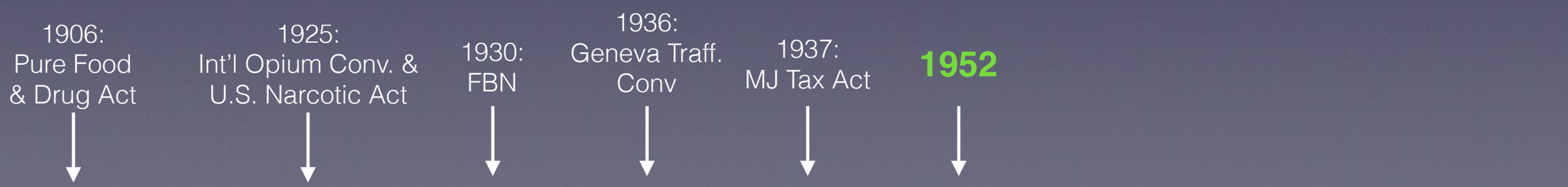
- Marihuana Tax Act (1937)
  - "The Marihuana Tax Act of 1937 effectively made possession or transfer of cannabis **ILLEGAL** throughout the United States under federal law"
  - Excluded medical & industrial uses; tax was excised



Frontline, www.pbs.org

The Story of Cannabis Regulation in the United States

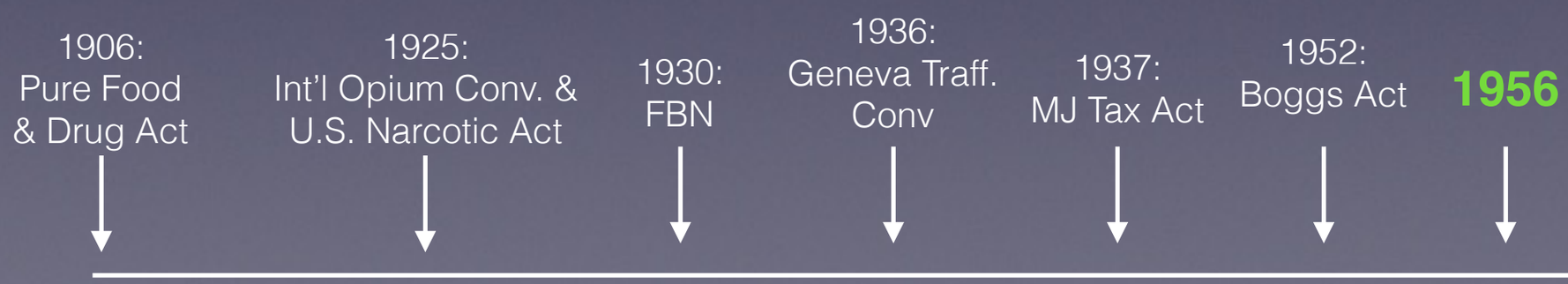
- Mandatory Sentencing: Boggs Act (1952)
  - Mandatory sentencing & increased punishment for first-time cannabis possession



Frontline, www.pbs.org

The Story of Cannabis Regulation in the United States

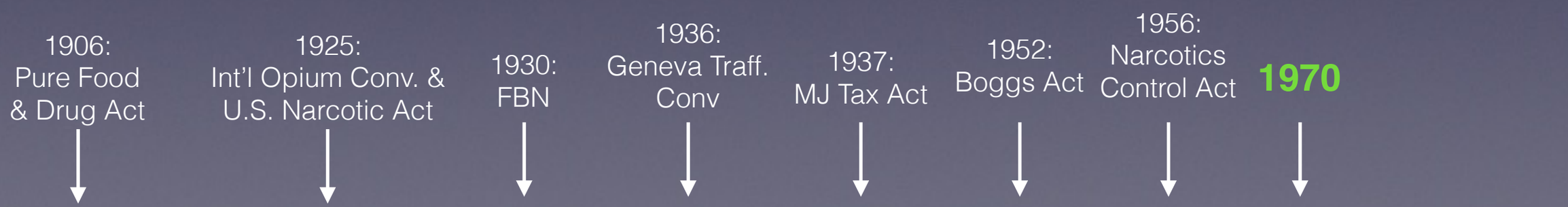
- Mandatory Sentencing: Narcotics Control Act (1956)
  - Mandatory sentencing & further increased punishment for first-time cannabis possession
  - Prison: 2-10 years
  - Fine: up to $20,000



Frontline, www.pbs.org

The Story of Cannabis Regulation in the United States

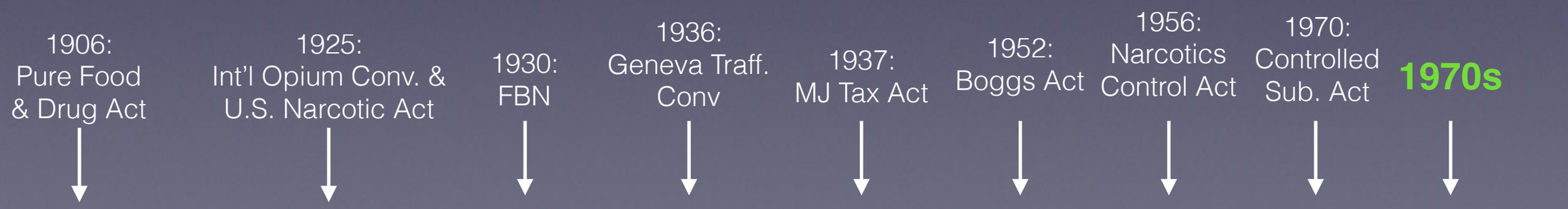
- Controlled Substances Act (1970)
    - *Leary v. United States* deemed MTA (1937) unconstitutional
        - Violated 5th Amendment right against self-incrimination
    - Congress passes Controlled Substances Act in response, thereby repealing MTA (1937)



Controlled Substances Act, www.fda.gov

The Story of Cannabis Regulation in the United States

- Decriminalization - 1970s
  - 1973: Oregon (OR)
  - 1974: Alaska (AK)
  - 1976: Maine (ME)
  - 1978: California (CA), Colorado (CO), Mississippi (MS), New York (NY), Nebraska (NE), North Carolina (NC), & Ohio (OH)



Pacula et al, 2003

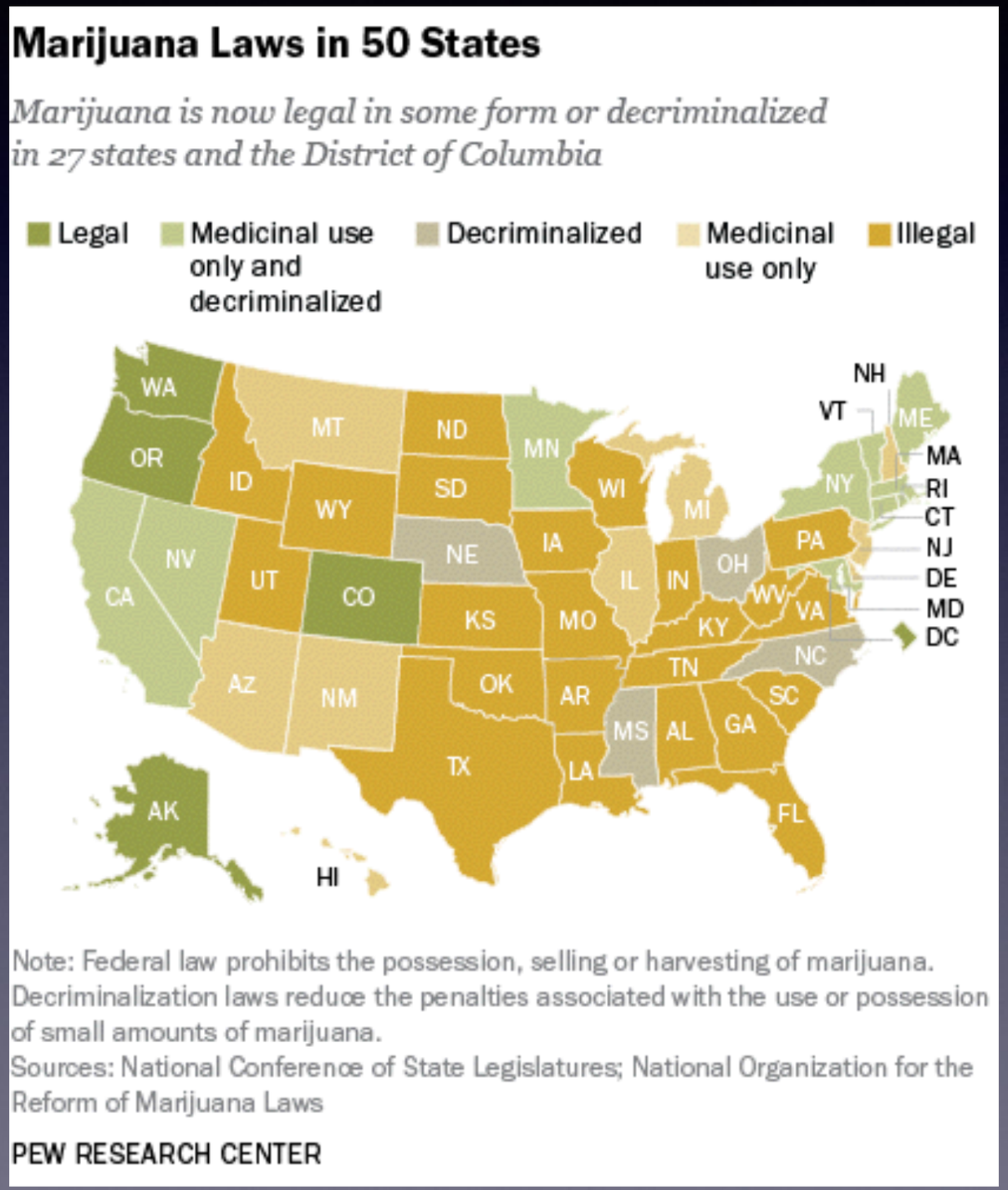
The Story of Cannabis Regulation in the United States

Medical Marijuana Legalization

Year	State
1996	Califronia (CA)
1998	Alaska (AK), Oregon (OR), Washington (WA)
1999	Maine (ME)
2000	Colorado (CO), Hawaii (HI), Nevada (NV)
2004	Montana (MT)
2006	Rhode Island (RI)
2007	New Mexico (NM), Vermont (VT)
2008	Michigan (MI)
2010	Arizona (AZ), New Jersey (NJ)
2011	Delaware (DE), Washington, D.C.
2012	Connecticut (CT), Massachusetts (MA)
2013	New Hampshire (NH), Illinois (IL)
2014	Maryland (MD), Minnesota (MN)

National Conference of State Legislators, www.ncsl.org, 2015

The Story of Cannabis Regulation in the United States



Motel et al, 2015

The Story of Cannabis Regulation in the United States

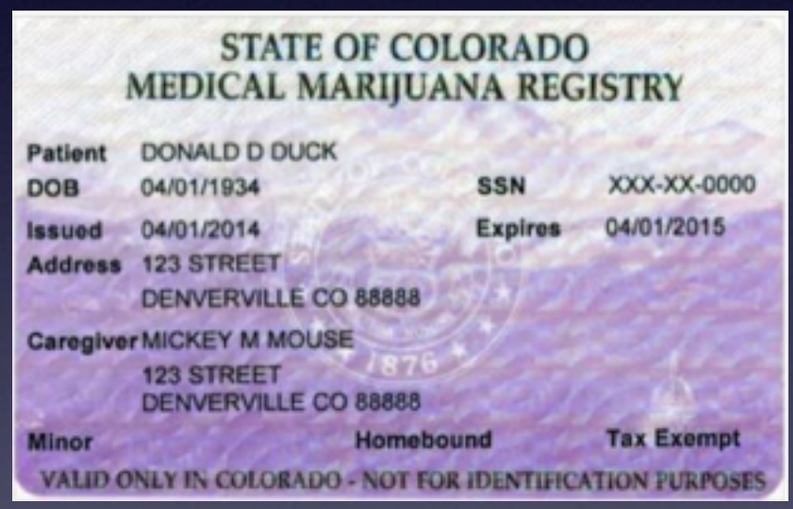
- "Increasingly positive & permissive public opinion despite scientific data about harm/consequences."
  - Potency
  - Sources
  - Availability
  - Public perception
  - Legal status
  - Patterns of use

Compton, 2014

The Story of Cannabis Regulation in Colorado

The Story of Cannabis Regulation in Colorado

- Amendment 20 (November 2000)
  - Medicinal cannabis use
  - "Provided defense for possession & use of cannabis for debilitating medical conditions when recommended by a physician"
  - Cancer, glaucoma, HIV/AIDS (also cachexia, severe pain, severe nausea, & persistent muscle spasm)


STATE OF COLORADO
MEDICAL MARIJUANA REGISTRY

Patient DONALD D DUCK
DOB 04/01/1934 SSN XXX-XX-0000
Issued 04/01/2014 Expires 04/01/2015
Address 123 STREET
DENVERVILLE CO 88888
Caregiver MICKEY M MOUSE
123 STREET
DENVERVILLE CO 88888
Minor Homebound Tax Exempt
VALID ONLY IN COLORADO - NOT FOR IDENTIFICATION PURPOSES

2000

Colorado Department of Public Health & Environment, www.colorado.gov, 2015

The Story of Cannabis Regulation in Colorado

- De Facto Legalization (July 2009)
  - Minimal restriction on eligibility for medical cannabis
  - Increase in patients: 5,000 to 120,000 in a year
  - Increase in dispensaries: just a few to ~700 in a year
  - Ogden Memo: Federal government has low priority for prosecuting individuals abiding by individual state cannabis laws
  - Colorado Board of Health fails to reach consensus regarding patient/ care-giver limit

Colorado Department of Public Health & Environment, www.colorado.gov, 2015
Ogden Memo, www.justice.gov, 2009

The Story of Cannabis Regulation in Colorado

- Senate Bill 109 (June 2010)
    - Required “bona fide physician-patient relationship”
    - Previously, NO exam to confirm existence of qualifying condition.

Colorado Department of Public Health & Environment, www.colorado.gov, 2015

The Story of Cannabis Regulation in Colorado

- Amendment 64 (November 2012)

DENVER VOTER RESULTS

AMENDMENT 64: REGULATING PERSONAL USE OF MARIJUANA

66% 186,671

34% 94,714

2000: Amend. 20

2009: de facto Legalization

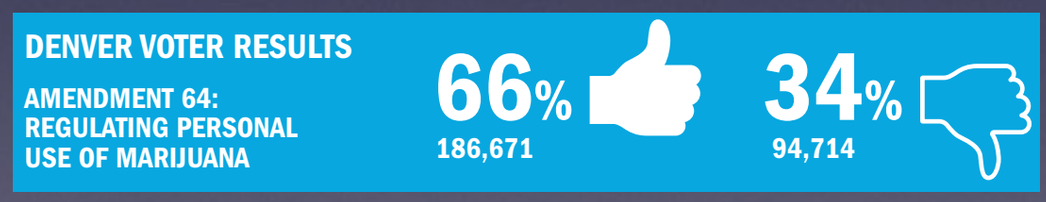
2010: Sen. Bill 109

2012

Colorado Department of Public Health & Environment, www.colorado.gov, 2015
City & County of Denver: Marijuana Annual Report, 2015

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



2000: Amend. 20

2009: de facto Legalization

2010: Sen. Bill 109

2012

Colorado Department of Public Health & Environment, www.colorado.gov, 2015
City & County of Denver: Marijuana Annual Report, 2015

The Story of Cannabis Regulation in Colorado

- Amendment 64 “Go Live” (January 1, 2014)

2000: Amend. 20

2009: de facto Legalization

2010: Sen. Bill 109

2012: Amend. 64

2014

www. denverpost.com
www.westword.com

The Story of Cannabis Regulation in Colorado

Let's Talk…

2000: Amend. 20

2009: de facto Legalization

2010: Sen. Bill 109

2012: Amend. 64

2014: Amend. 64 "Go Live"

Today

www.slate.com
www.cnn.com
www.huffingtonpost.com

The Story of Cannabis Regulation in Colorado: Post-Legalization

RETAIL MARIJUANA: THE DENVER COLLABORATIVE APPROACH

DENVER
THE MILE HIGH CITY

	CULTIVATION FACILITIES	MIPS	TESTING FACILITIES	RETAIL STORES
1/1/14	20	4	0	19
1/1/15	154	41	7	106

Retail Marijuana Businesses

- 4 types of licenses:
  - Cultivation facilities
  - Manufacturers of Infused Products (MIPS)
  - Marijuana testing facilities
  - Retail stores

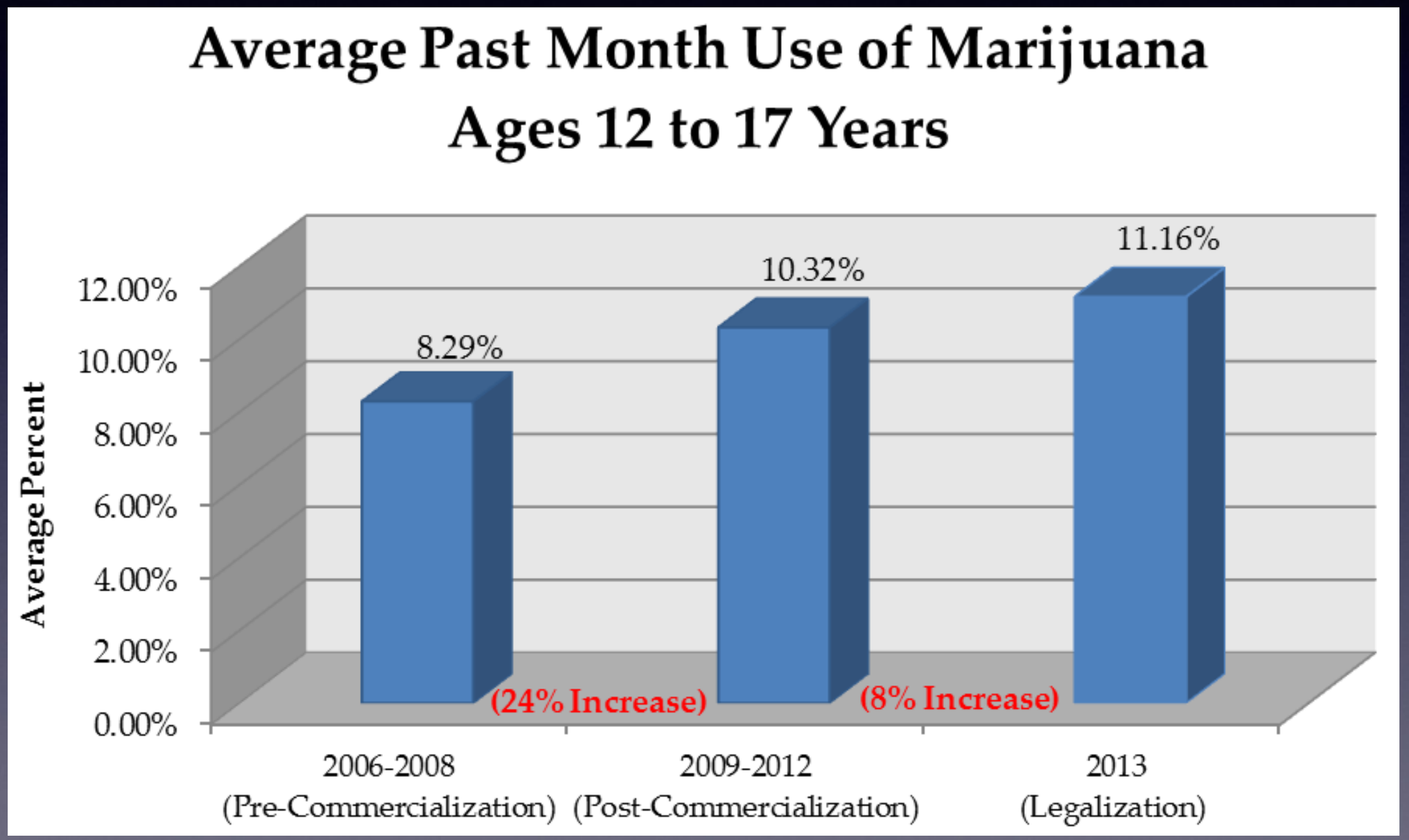
City & County of Denver: Marijuana Annual Report, 2015

Youth Cannabis Use

- Past Month Marijuana Use (2013), age 12-17
  - National average: 7.15%
  - Colorado average: **11.16**%
    - ↑ **6.6**% in just one year after legalization
- Colorado ranked **3rd** in the nation for current marijuana use
  - 56.08% higher than U.S. national average
  - 2006: Colorado ranked 14th in the U.S. for current marijuana use

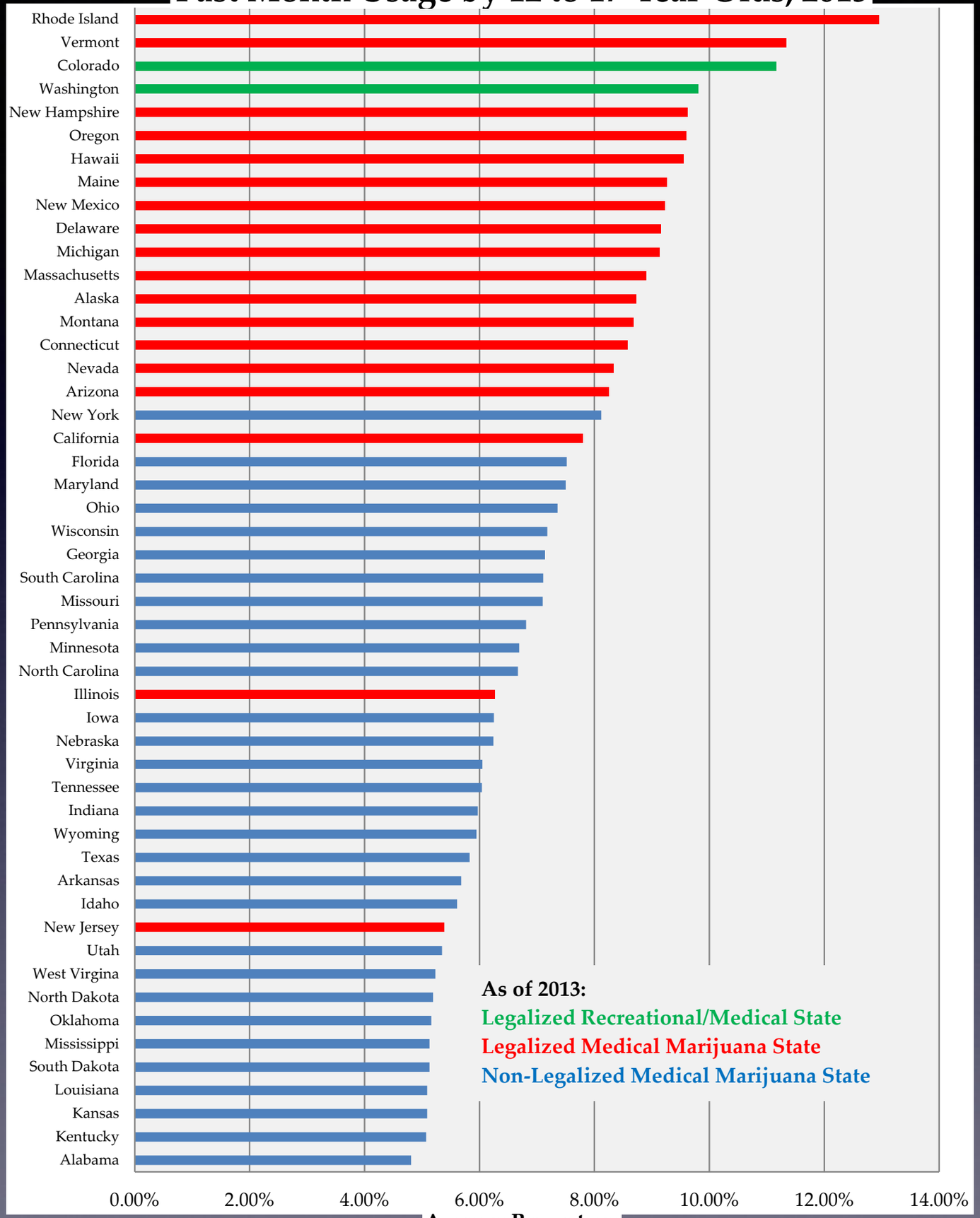
The Legalization of Marijuana in Colorado: The Impact Vol. 3, Preview 2015
Rocky Mountain High Intensity Drug Trafficking Area (www.rmhidta.org)

Youth Cannabis Use in Colorado



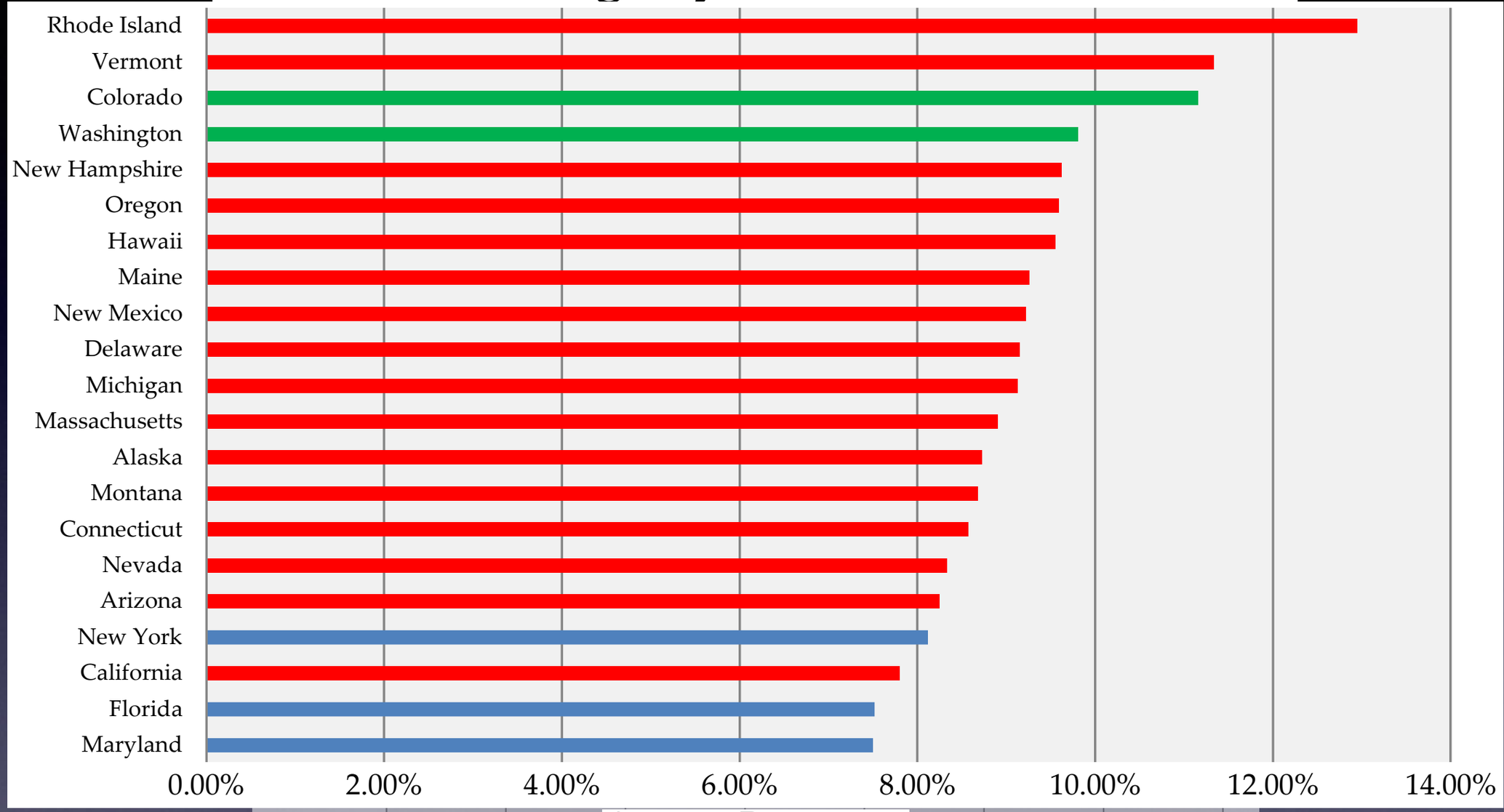
SAMHSA.gov, National Survey on Drug Use and Health 2012 and 2013

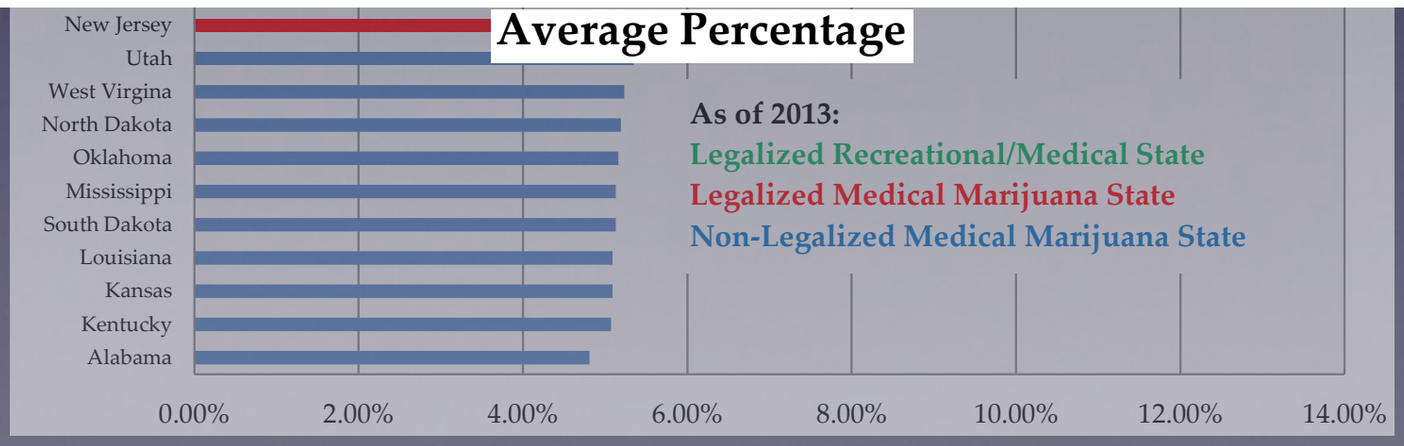
Past Month Usage by 12 to 17-Year-Olds, 2013



SAMHSA.gov, National Survey on Drug Use and Health 2012 and 2013

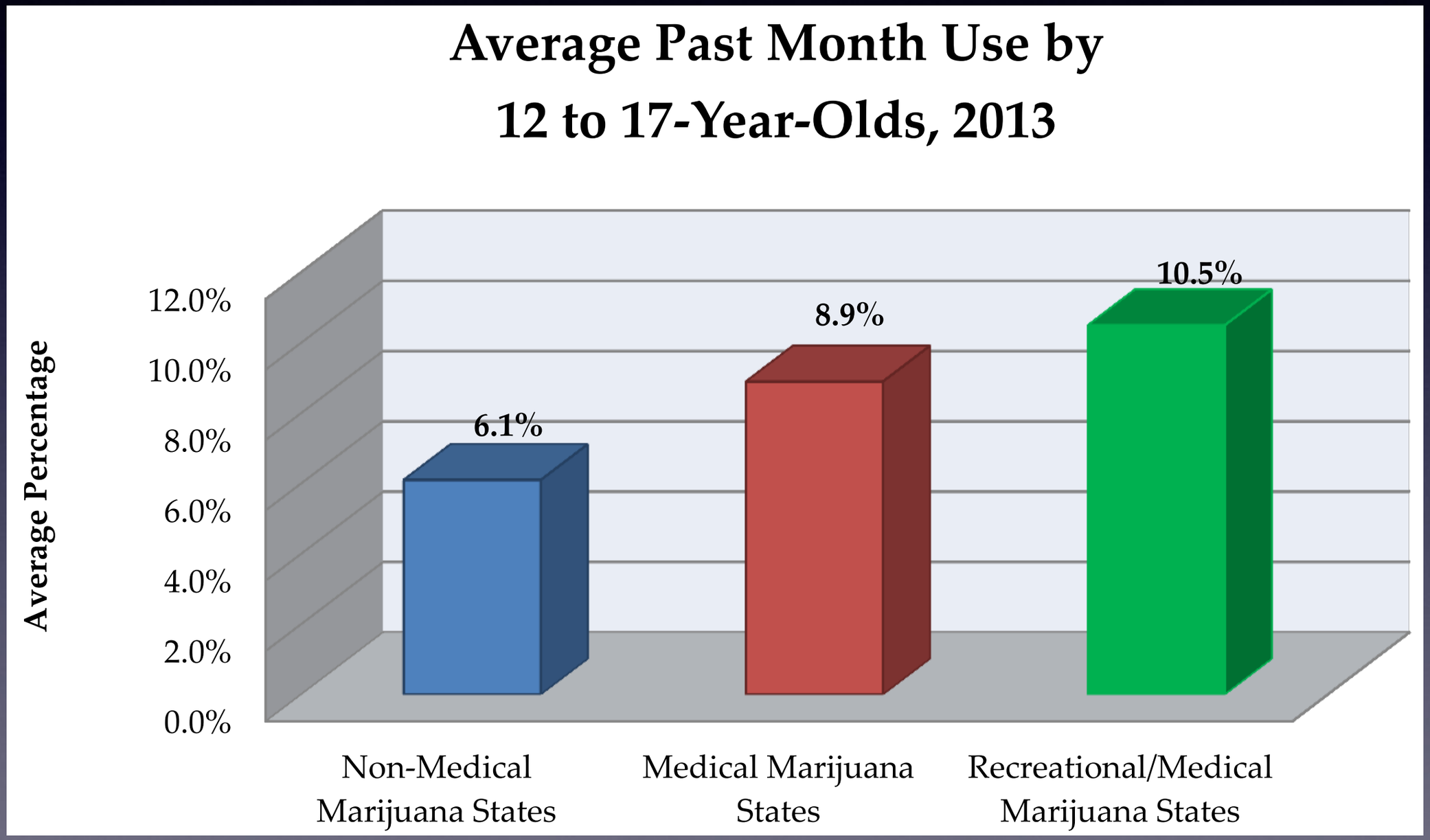
Past Month Usage by 12 to 17-Year-Olds, 2013





SAMHSA.gov, National Survey on Drug Use and Health 2012 and 2013

Youth Cannabis Use



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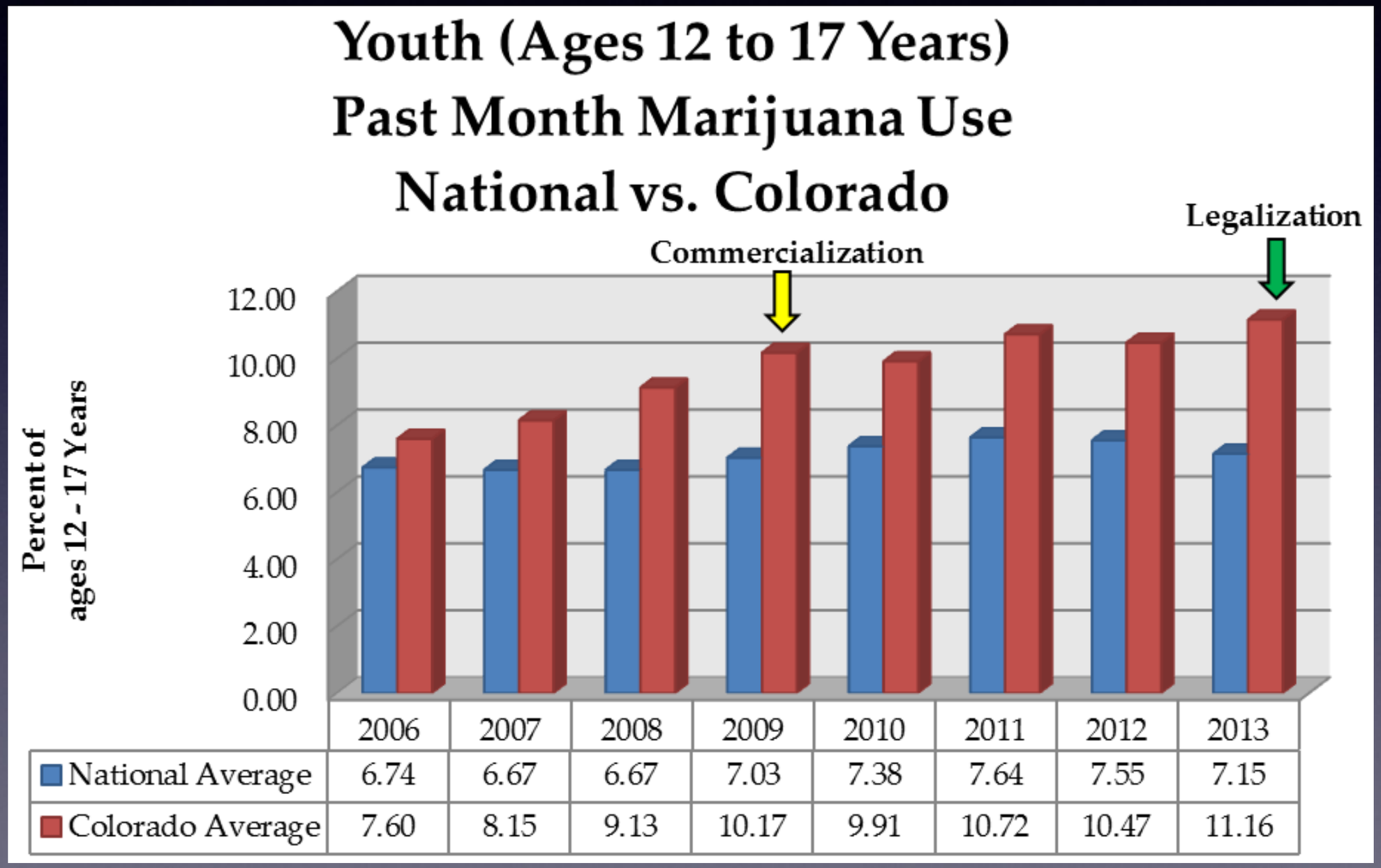
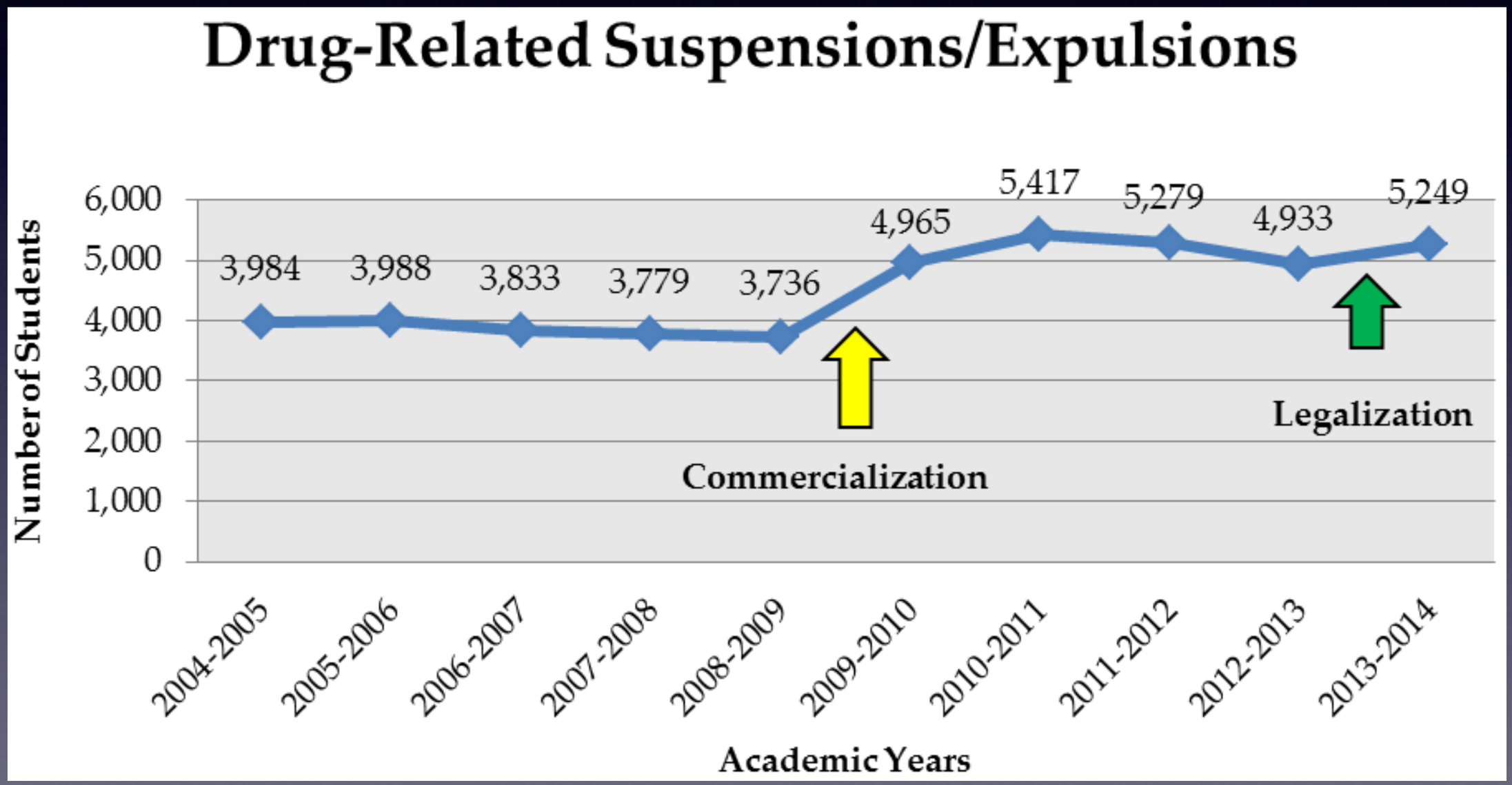


	2006	2007	2008	2009	2010	2011	2012	2013
National Average	6.74	6.67	6.67	7.03	7.38	7.64	7.55	7.15
Colorado Average	7.60	8.15	9.13	10.17	9.91	10.72	10.47	11.16

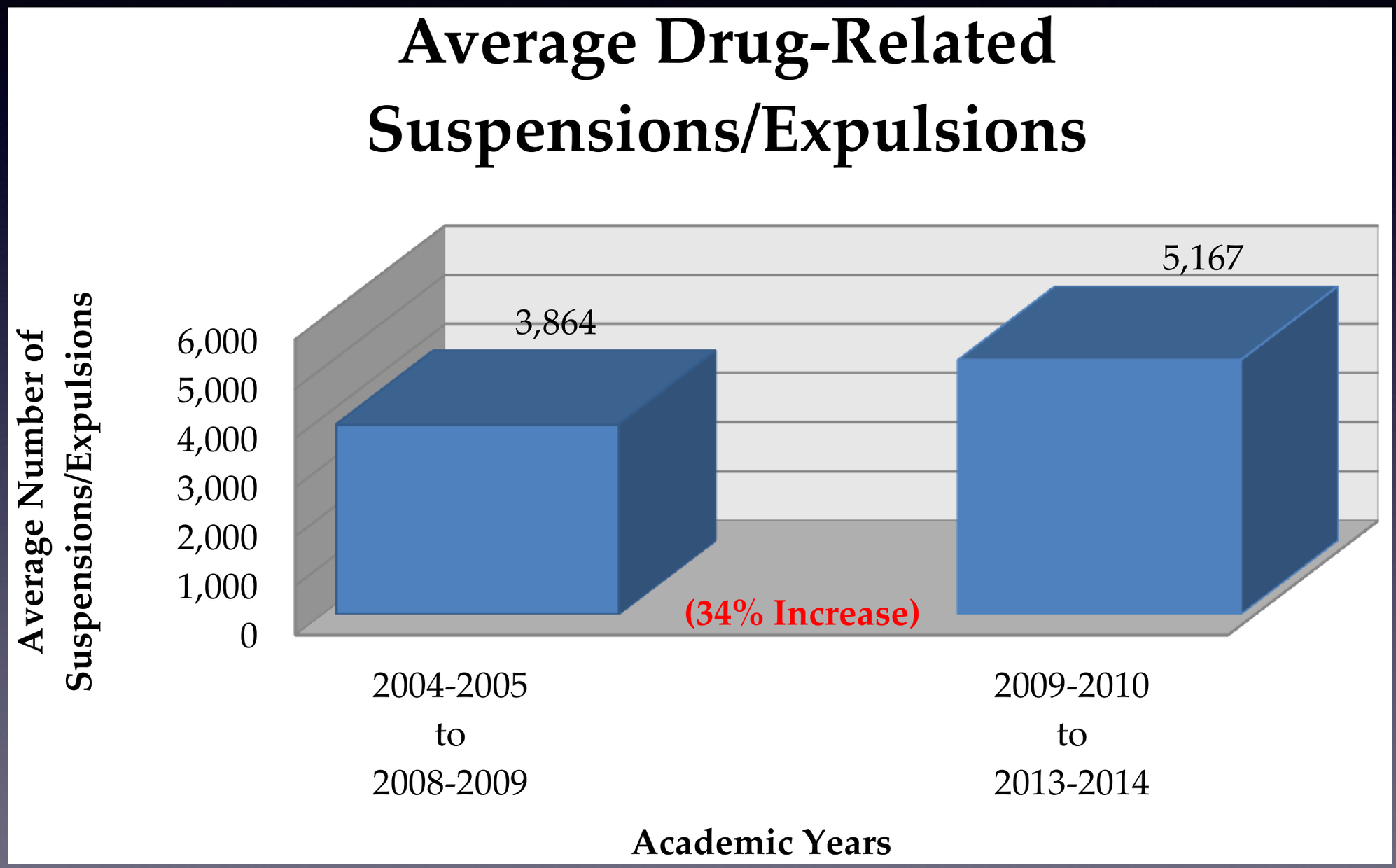
SAMHSA.gov, National Survey on Drug Use and Health 2012 and 2013

Youth Cannabis Use in Colorado



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

Youth Cannabis Use in Colorado



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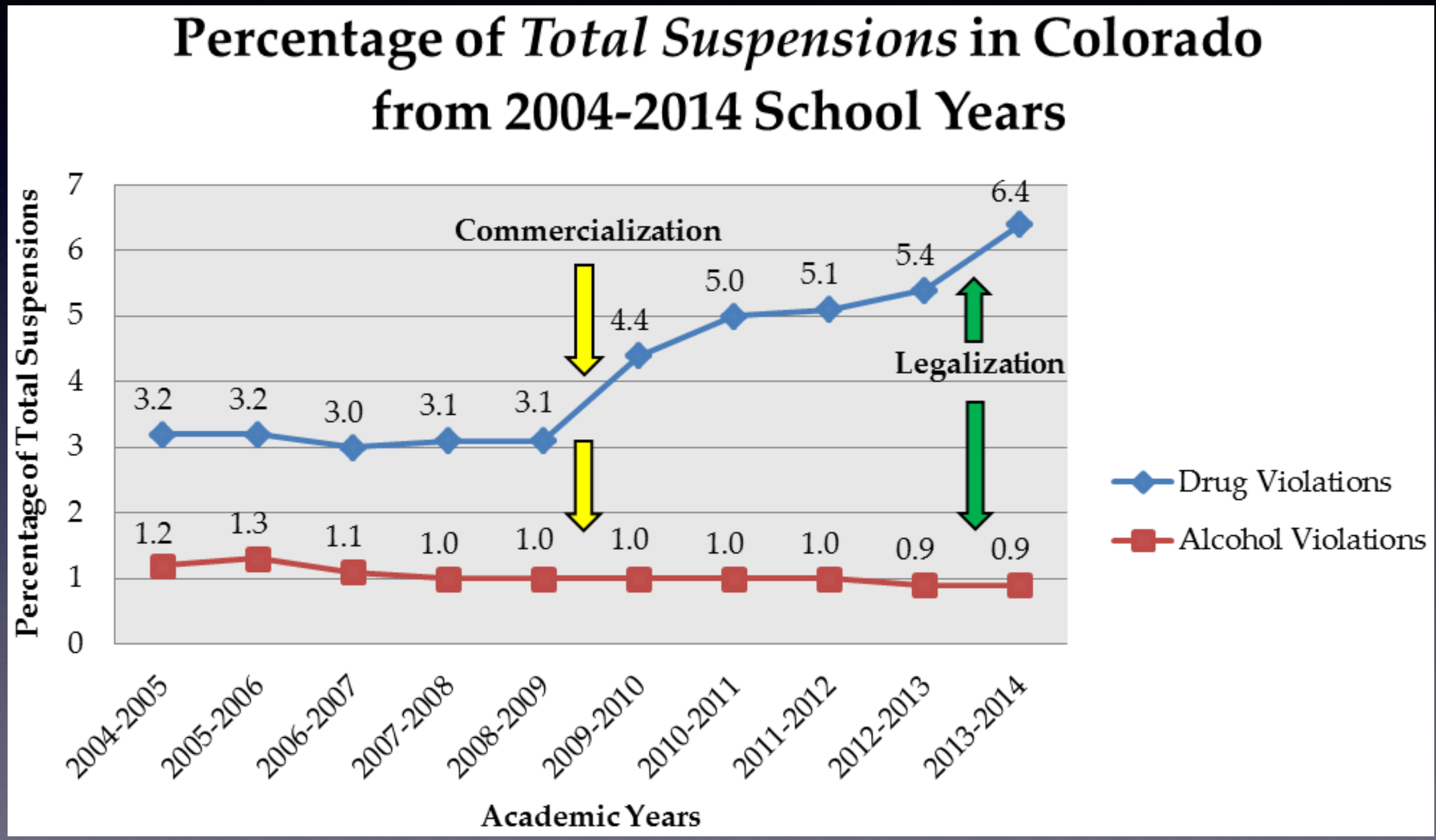

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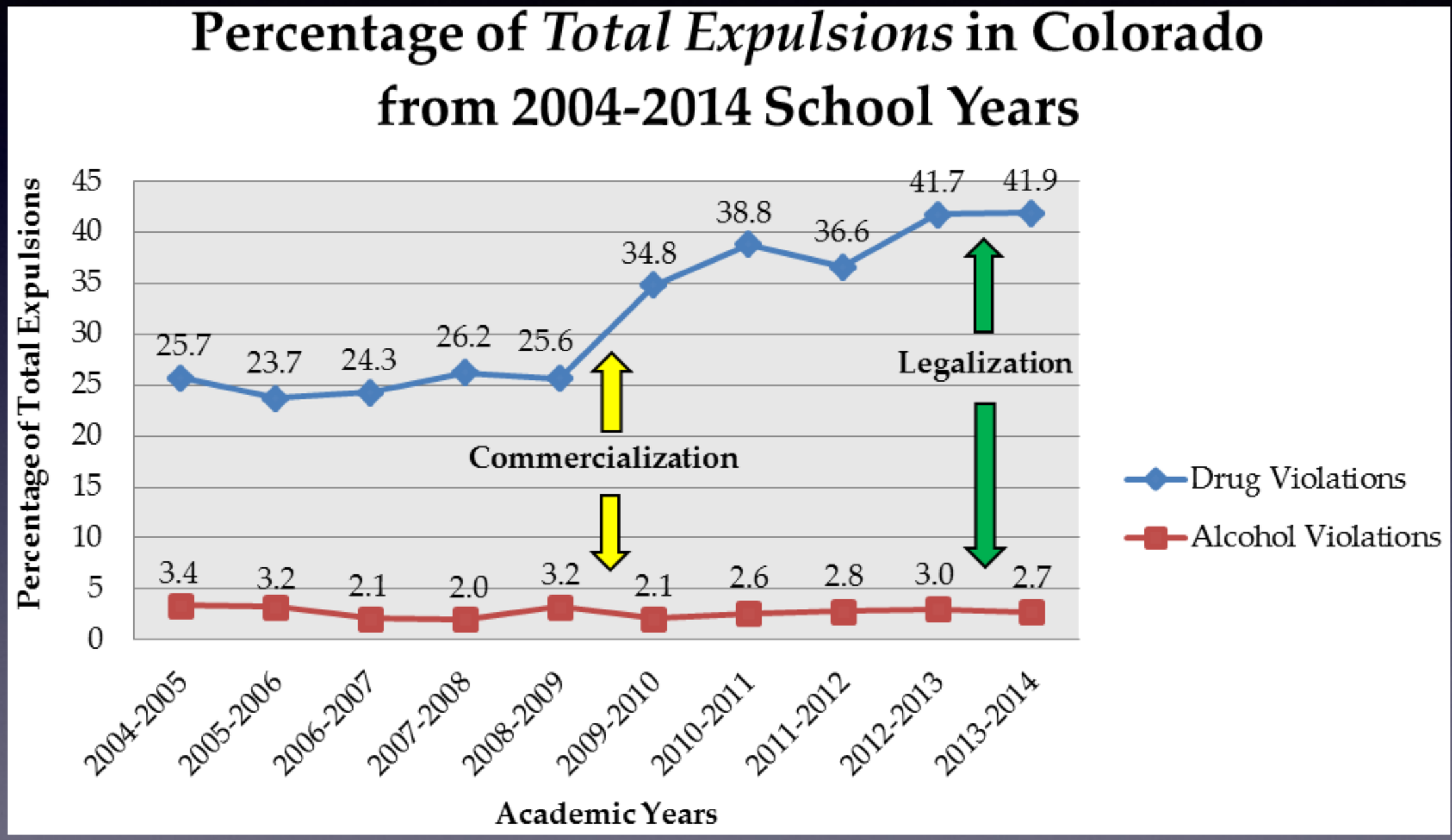

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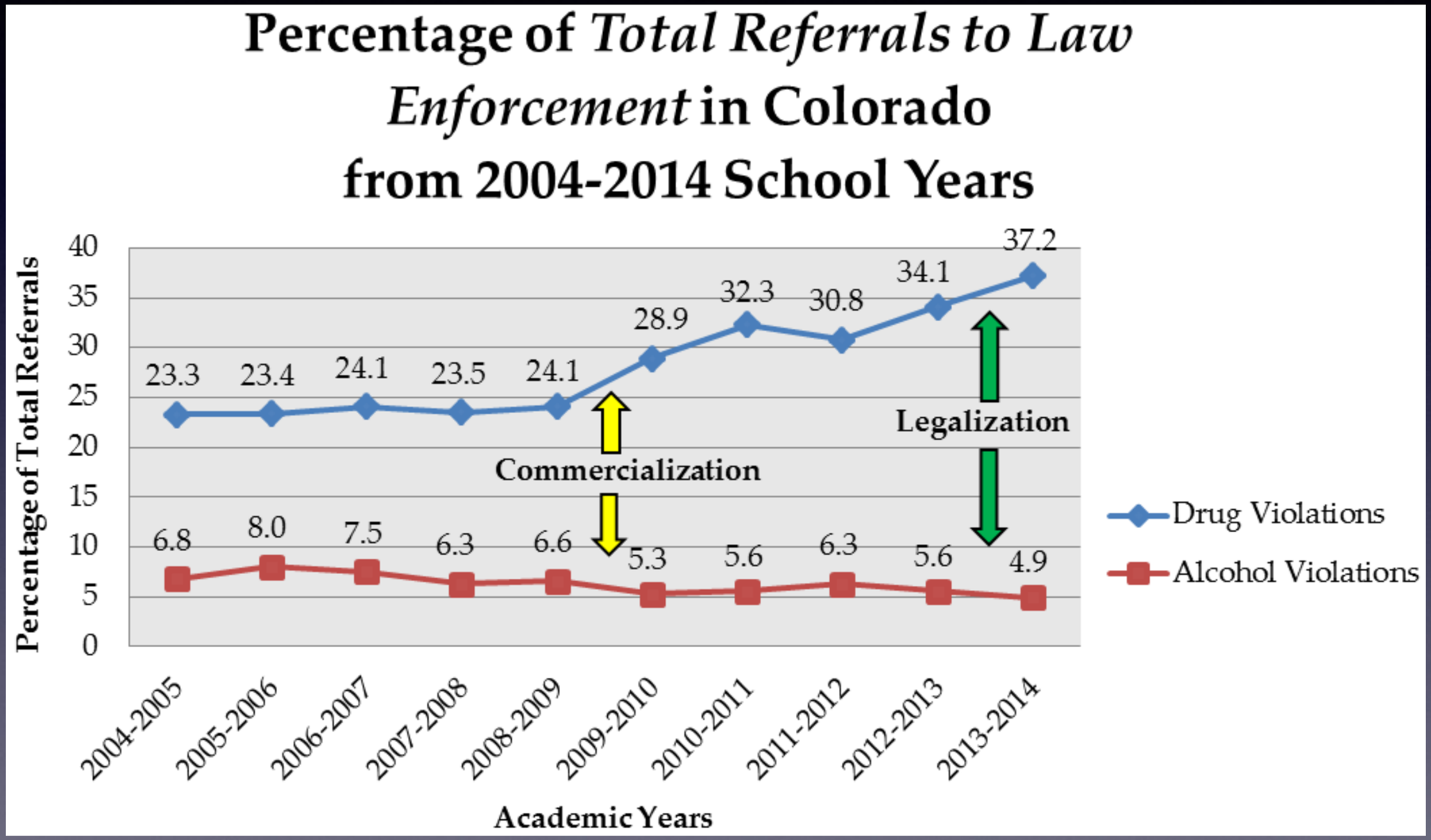

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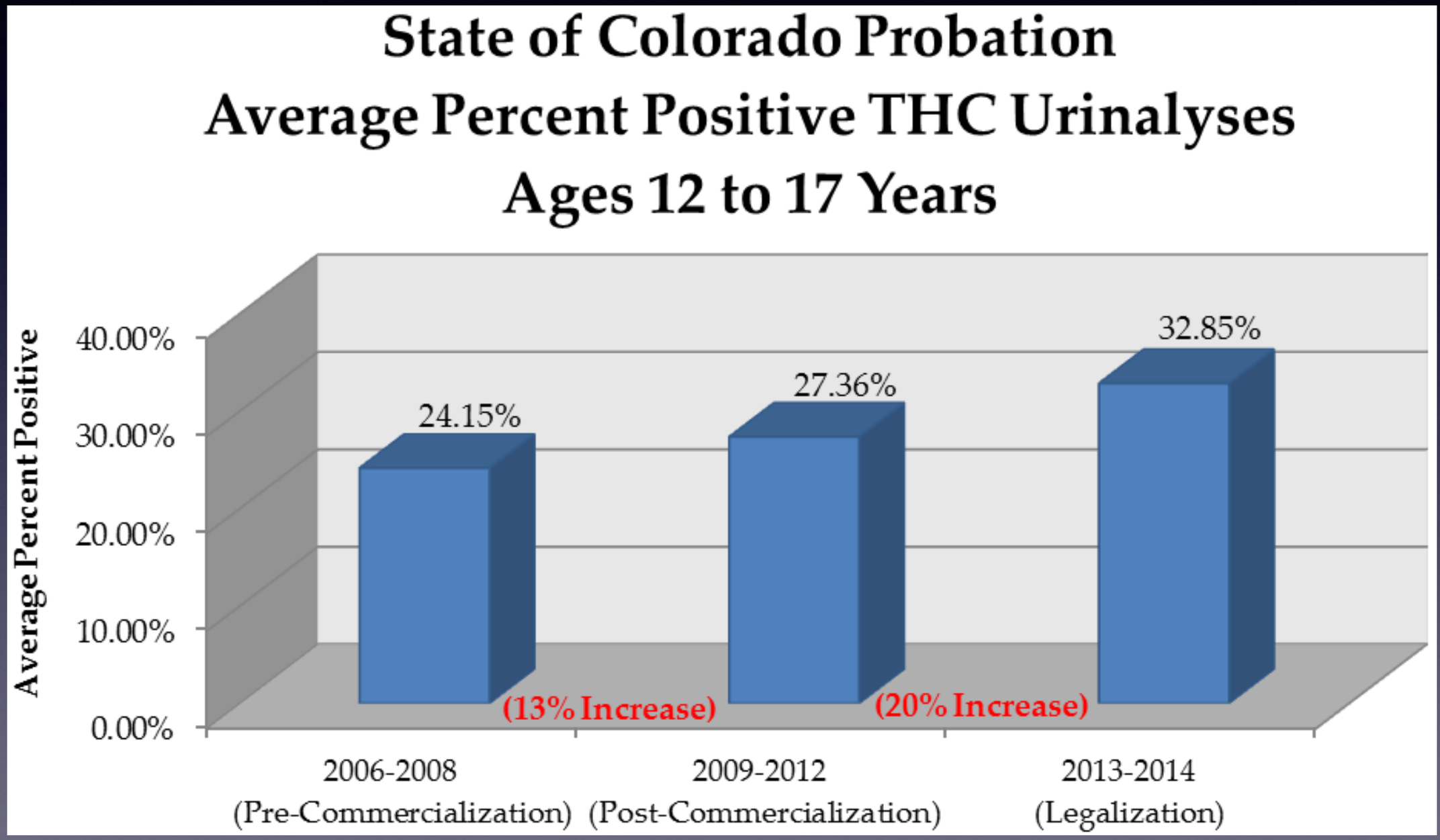


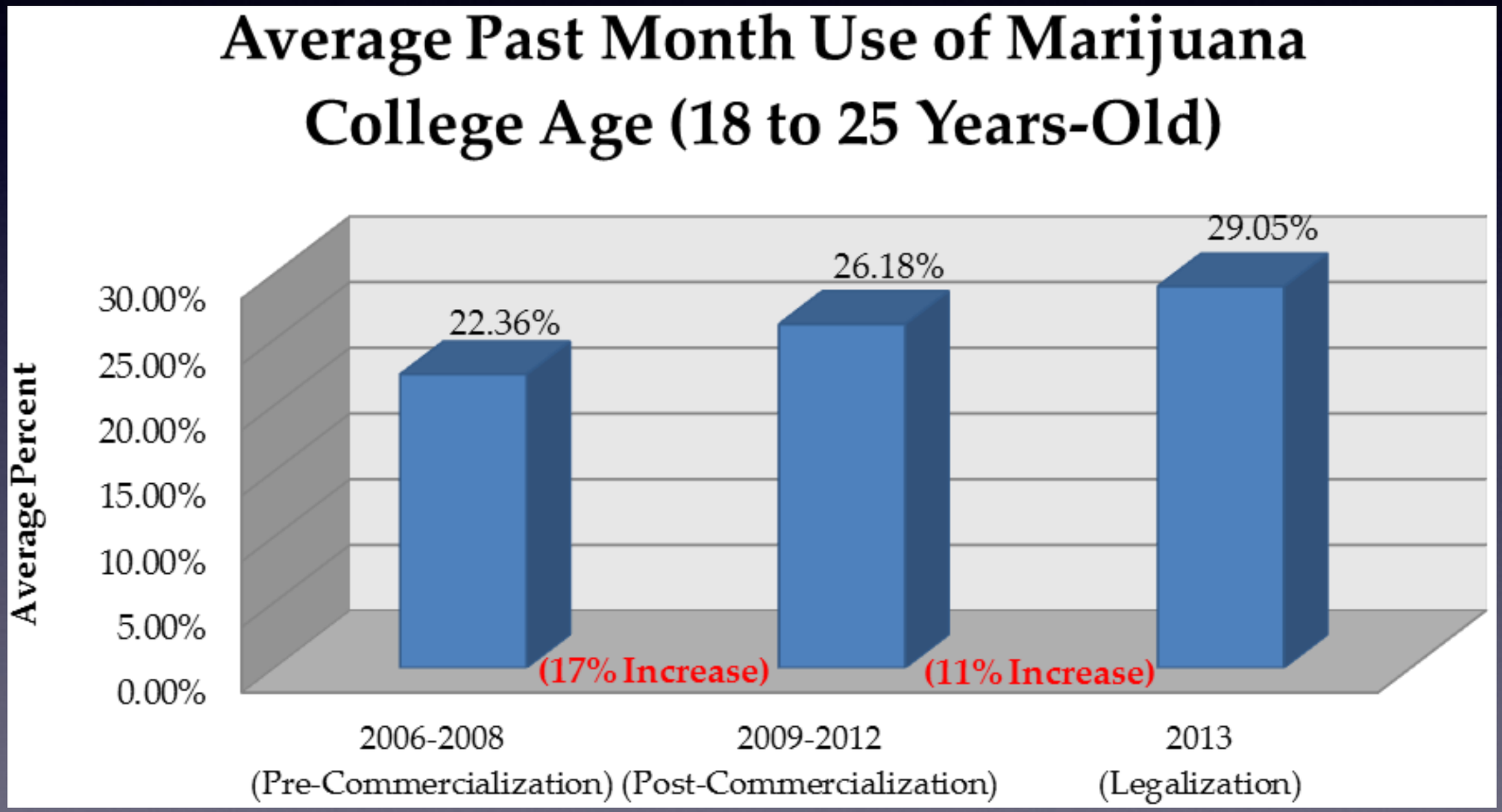
Colorado Department of Education
10-Year Trend Data: State Suspension and Expulsion Incident Rates and Reasons

Young Adult Cannabis Use

- Current Marijuana Use (2013), College Age Adults (age 18-25)
    - National average: 18.91%
    - Colorado average – **29.05%**
    - Colorado was ranked **2nd** in the nation for current marijuana use
        - 53.62% higher than U.S. national average
        - 2006: Colorado was ranked 8th in the nation for current marijuana use
    - In just one year since Colorado legalized recreational marijuana, past month marijuana use increased **8.4%**

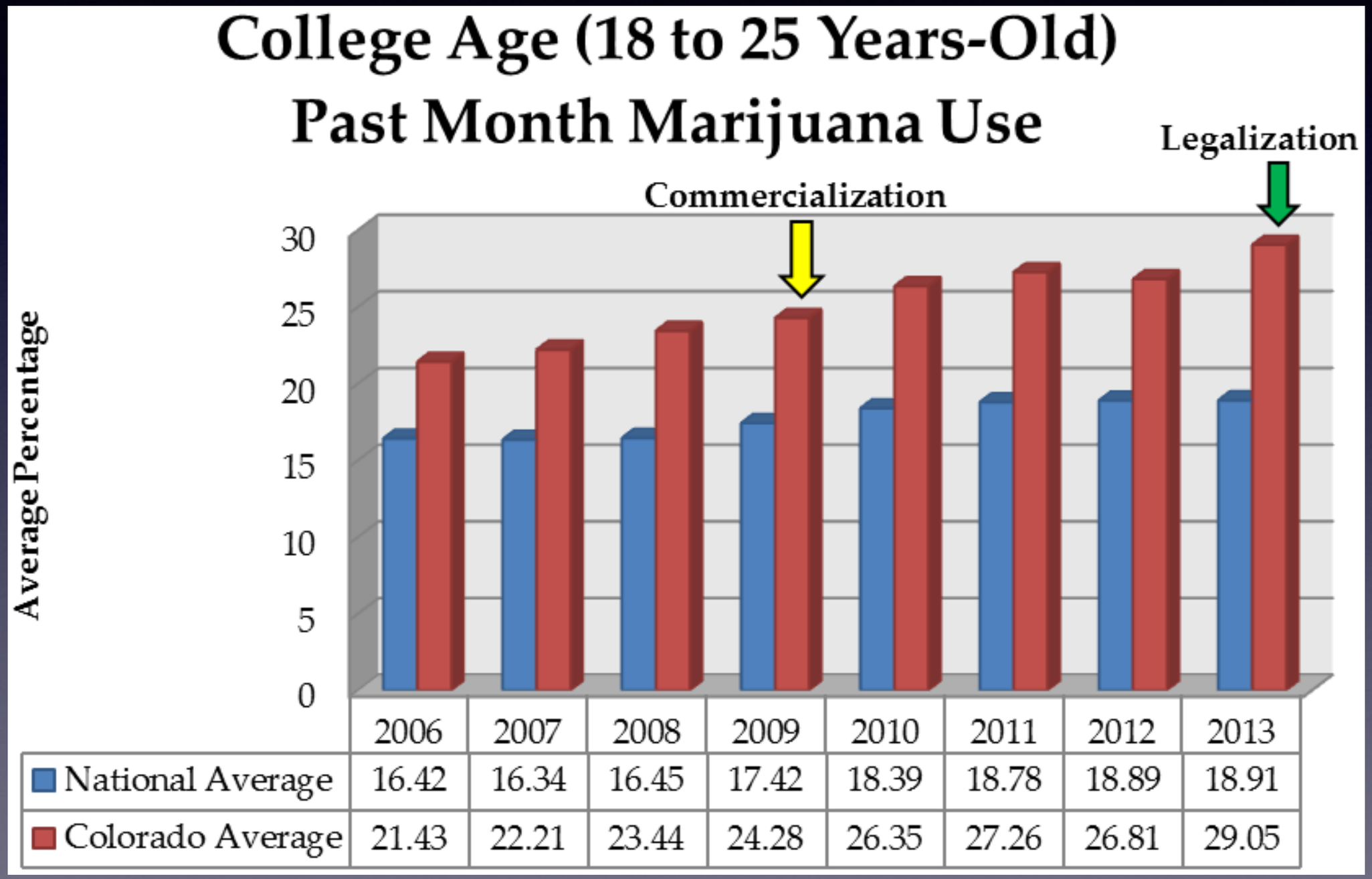
The Legalization of Marijuana in Colorado: The Impact Vol. 3, Preview 2015
Rocky Mountain High Intensity Drug Trafficking Area (www.rmhidta.org)

Young Adult Cannabis Use in Colorado



SAMHSA.gov, National Survey on Drug Use and Health, 2006–2013

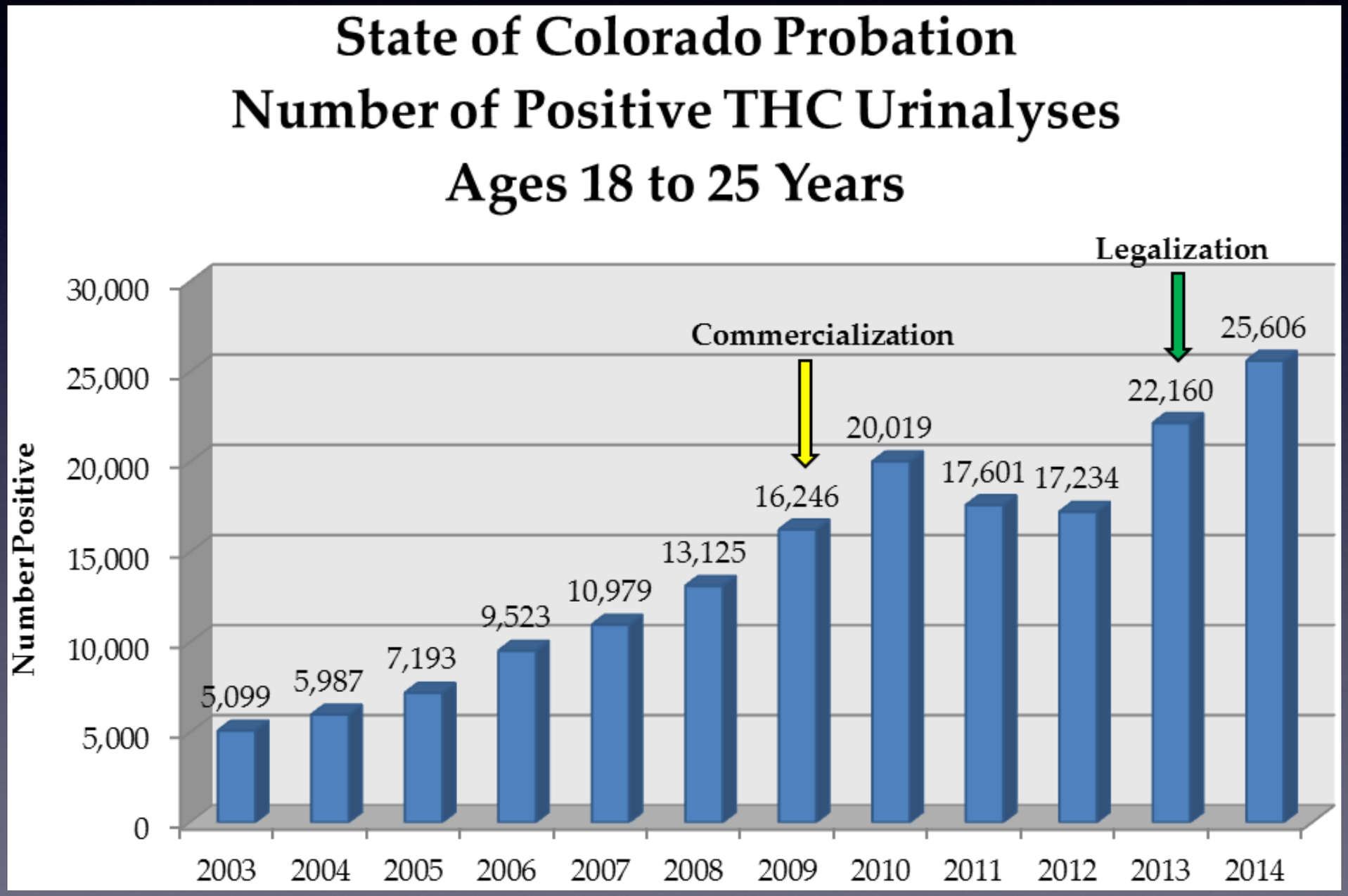
Young Adult Cannabis Use



	2006	2007	2008	2009	2010	2011	2012	2013
National Average	16.42	16.34	16.45	17.42	18.39	18.78	18.89	18.91
Colorado Average	21.43	22.21	23.44	24.28	26.35	27.26	26.81	29.05

SAMHSA.gov, National Survey on Drug Use and Health, 2006–2013

Young Adult Cannabis Use



State of Colorado Judicial Branch, Division of Probation Services

Cannabis in the Media

What Can We Do?

Hopeless?

Don’t be!

ENCOMPASS/STEP

- 17 week, outpatient manualized treatment (dual-diagnosis)
- Cognitive Behavioral Therapy (CBT)
- Motivational Enhancement (MET)
- Contingency Management (CM)

www.ucdenver.edu/academics/colleges/medicalschool/departments/psychiatry/Research/Subdep/ENCOMPASS/Pages/default.aspx

Treatment

ENCOMPASS

Integrated Treatment for Adolescents and Young Adults

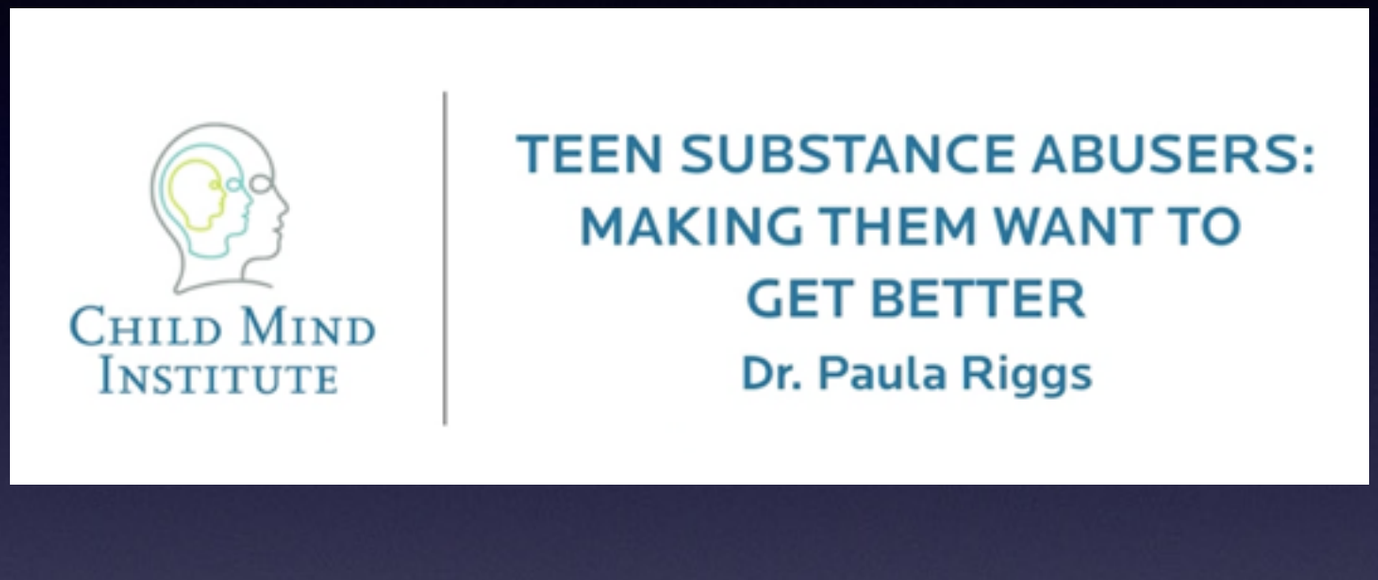
DENVER HEALTH

Level One Care for ALL

STEP PROGRAM

www.denverhealth.org/medical-services/mental-health/our-services/step-program

Strategies for Treatment



Summary & Take-Home Points

- Cannabis is a harmful substance that can have serious consequences on the mind and body
- Legalization/commercialization of a substance impacts perception and use by youth
- Prevention & education are key
- Treatment is available: ENCOMPASS/STEP

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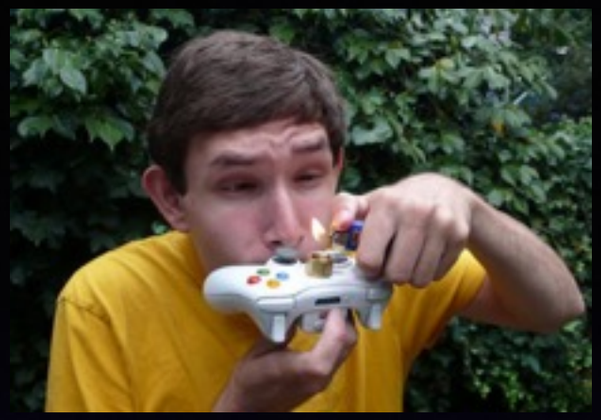
Questions?



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