

# The Health Effects of Cannabis

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**NOTE:** The UVM College of Medicine and UVM Medical Center do not have an official position on the legalization of marijuana. The slides and views are my own.

# Disclosures of Potential Conflicts

I do not receive any funding from any pharmaceutical or medical device company. I do receive royalties from a book published by WW Norton and from my blog at Psychology Today



## Blogs

<http://blog.uvm.edu/drettew>

**Psychology Today**

<http://www.psychologytoday.com/blog/abcs-child-psychiatry>

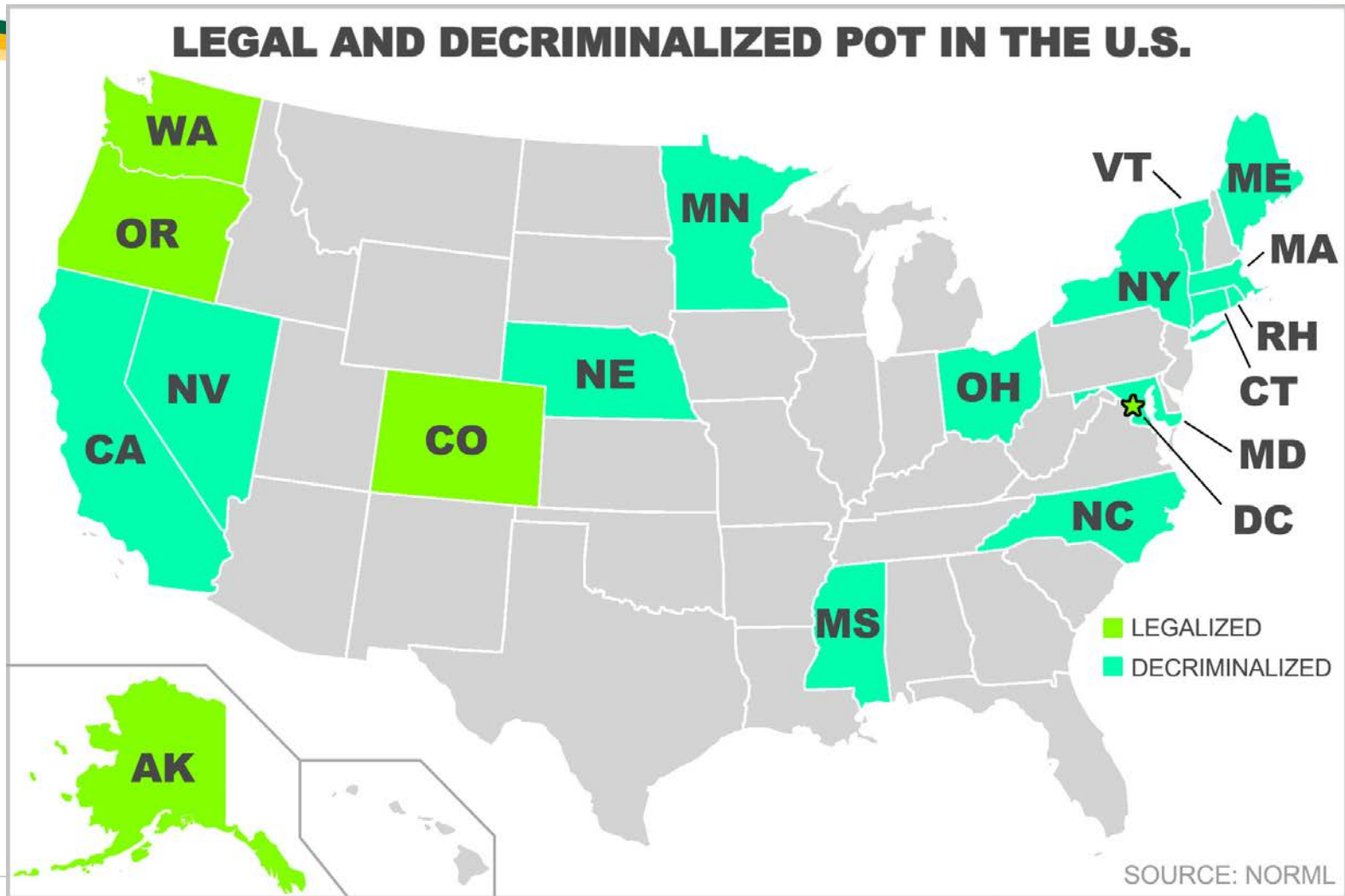


THE  
University of Vermont  
Children's Hospital

# Some Material Adapted from the Following

- Alan Budney, PhD
- Jim Hudziak, MD
- Sharon Levy, M

# Legalization of Cannabis



# Why are cannabis risks not fully appreciated?

- Potential conflicts on interest due to...
  - Some legalization advocates personal use impacting objective judgement of risk
  - Financial gains of potential short-term revenue source from taxation of cannabis products

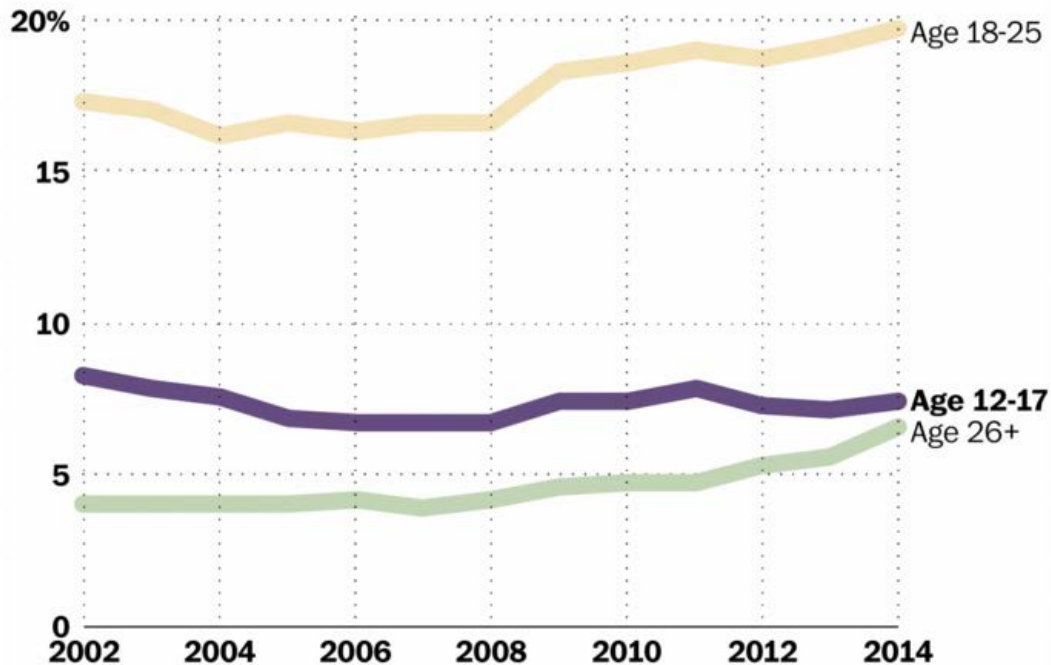
# Rates and Pattern of Cannabis Use



# National Cannabis Use Trends

## Teen marijuana use holds steady

Past-month marijuana use by age group, 2002 to 2014



WAPO.ST/WONKBLOG

Source: 2014 National Survey on Drug Use And Health

# Cannabis Use in Youth Relatively Stable

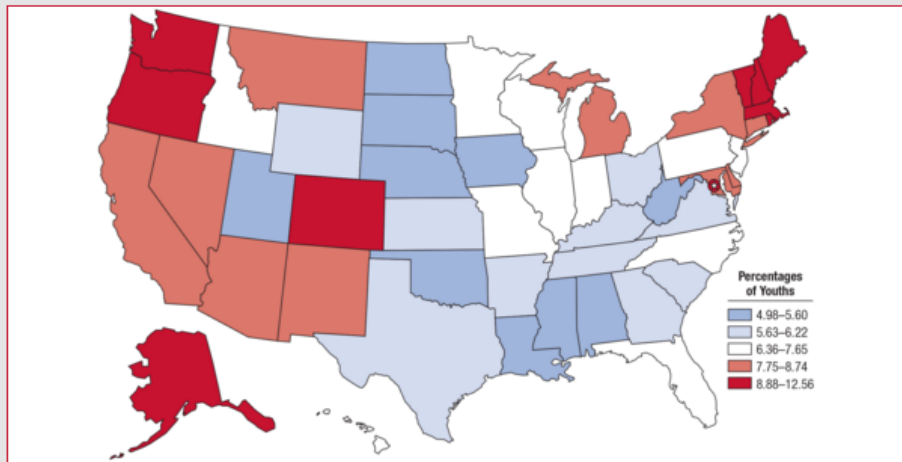
**Monitoring the Future Study: Trends in Prevalence of Various Drugs for 8th Graders, 10th Graders, and 12th Graders; 2012 - 2015 (in percent)\***

Drug	Time Period	8th Graders				10th Graders				12th Graders			
		2012	2013	2014	2015	2012	2013	2014	2015	2012	2013	2014	2015
<b>Marijuana/ Hashish</b>	Lifetime	15.20	16.50	15.60	<b>15.50</b>	33.80	35.80	33.70	<b>[31.10]</b>	45.20	45.50	44.40	<b>44.70</b>
	Past Year	11.40	12.70	11.70	<b>11.80</b>	28.00	29.80	[27.30]	<b>25.40</b>	36.40	36.40	35.10	<b>34.90</b>
	Past Month	6.50	7.00	6.50	<b>6.50</b>	17.00	18.00	16.60	<b>14.80</b>	22.90	22.70	21.20	<b>21.30</b>
	Daily	1.10	1.10	1.00	<b>1.10</b>	3.50	4.00	[3.40]	<b>3.00</b>	6.50	6.50	5.80	<b>6.00</b>



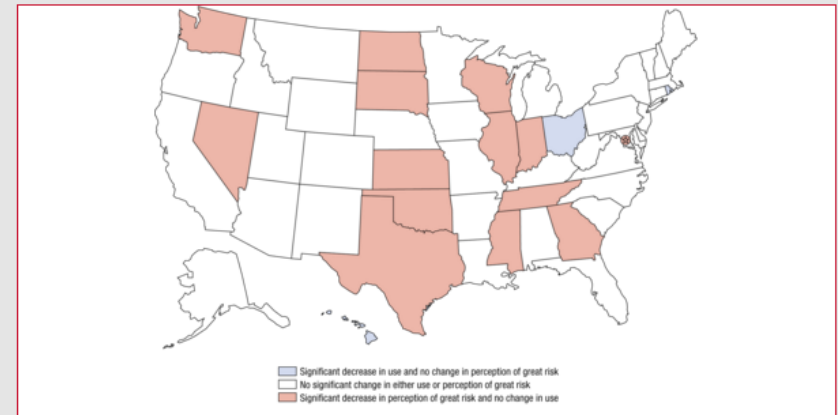
# State Variability in Teen Cannabis Use

Figure 1. Marijuana use in the past month among youths aged 12 to 17, by state: percentages, annual averages, 2013–2014



Source: SAMHSA, Center for Behavioral Health Statistics and Quality, National Surveys on Drug Use and Health (NSDUHs), 2013 and 2014.

Figure 3. States with significant change in past month marijuana use and perceptions of great risk of harm from smoking marijuana once a month among youths aged 12 to 17: combined 2012–2013 versus combined 2013–2014



Note: Statistically significant changes are at the .05 level of significance.

Source: SAMHSA, Center for Behavioral Health Statistics and Quality, National Surveys on Drug Use and Health (NSDUHs), 2012, 2013, and 2014.

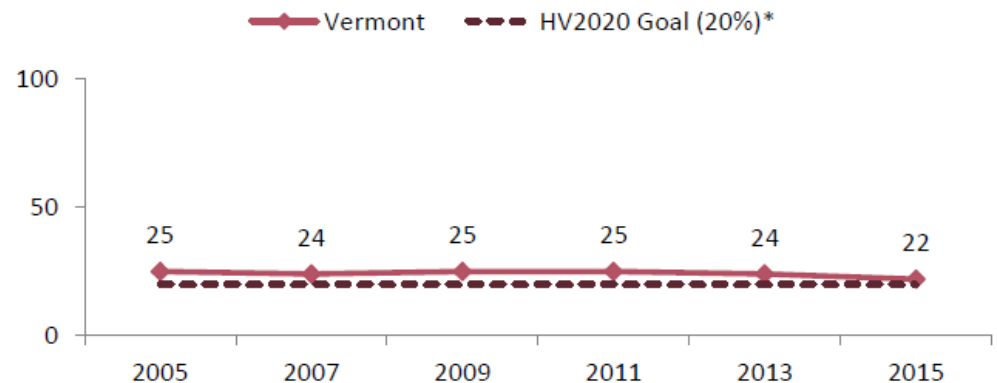
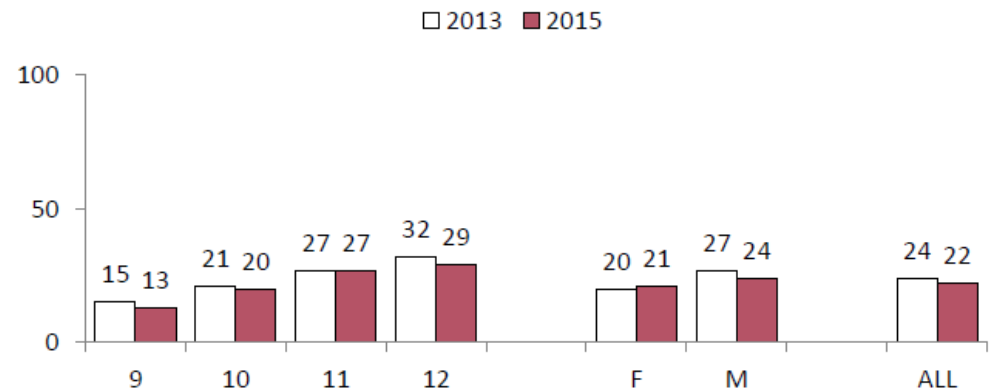
Overall past month usage in 12-17 age group statistically unchanged  
From 7.15% to 7.22%

# Vermont Teen Cannabis Use High but Not Increasing

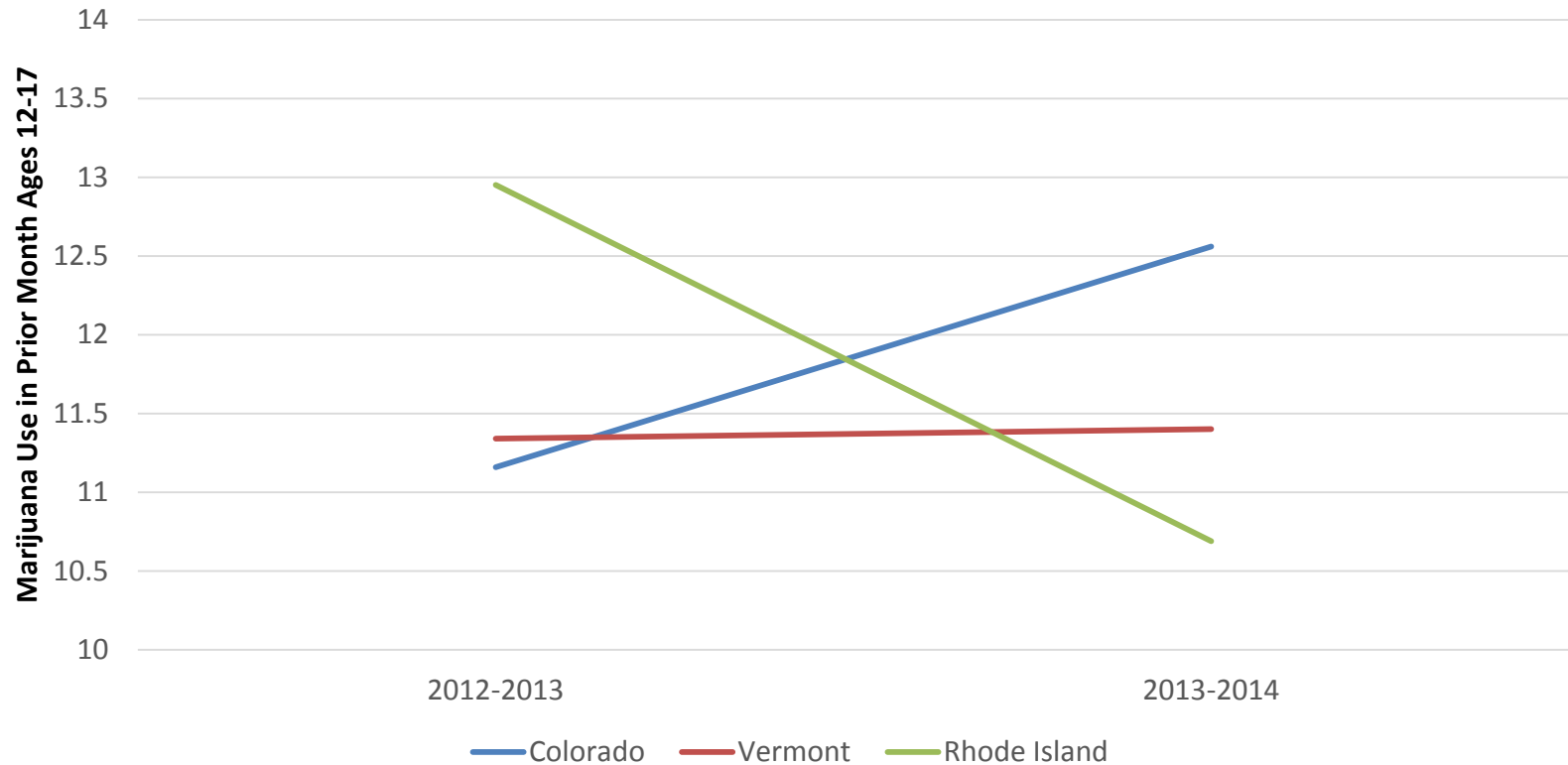
## Marijuana Use in the Past 30 Days

- **Just over one in five students (22%) used marijuana at least one time during the past 30 days.**
- Males were significantly more likely to use marijuana than females.
- Current marijuana use increased significantly from ninth through eleventh grade.
- Current marijuana use was similar in 2013 and 2015. Current marijuana use remains above the Healthy Vermonters 2020 goal of 20%.

Percent of students who used marijuana one or more times during the past 30 days



# Teen Cannabis In 3 Highest Use States

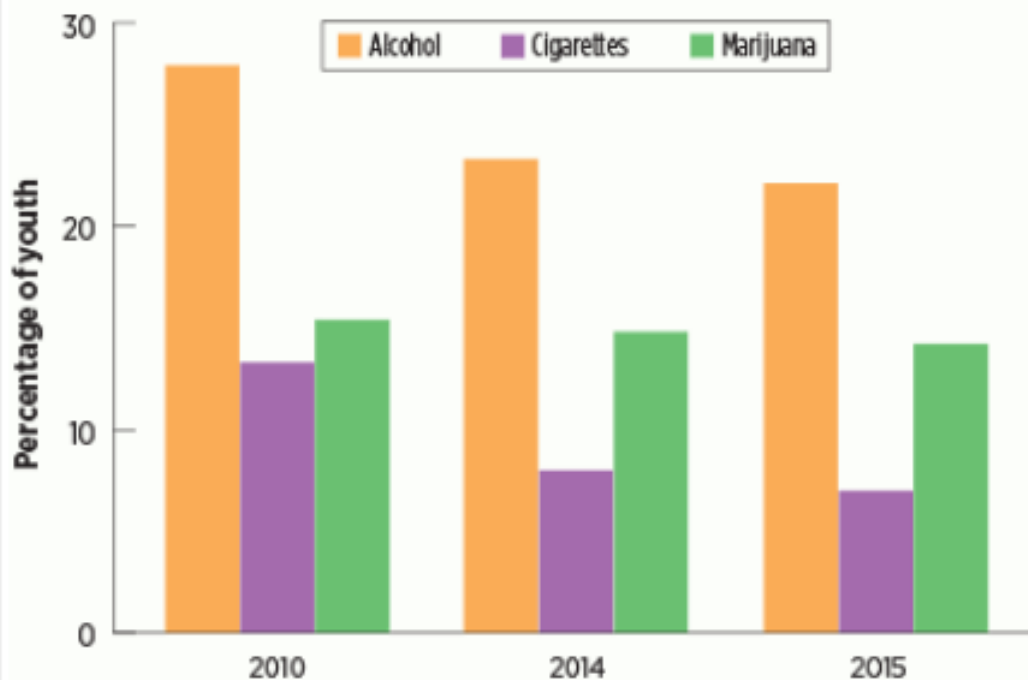


Colorado 2011-2012 rate: 10.47%

# Substances Except Cannabis Dropping

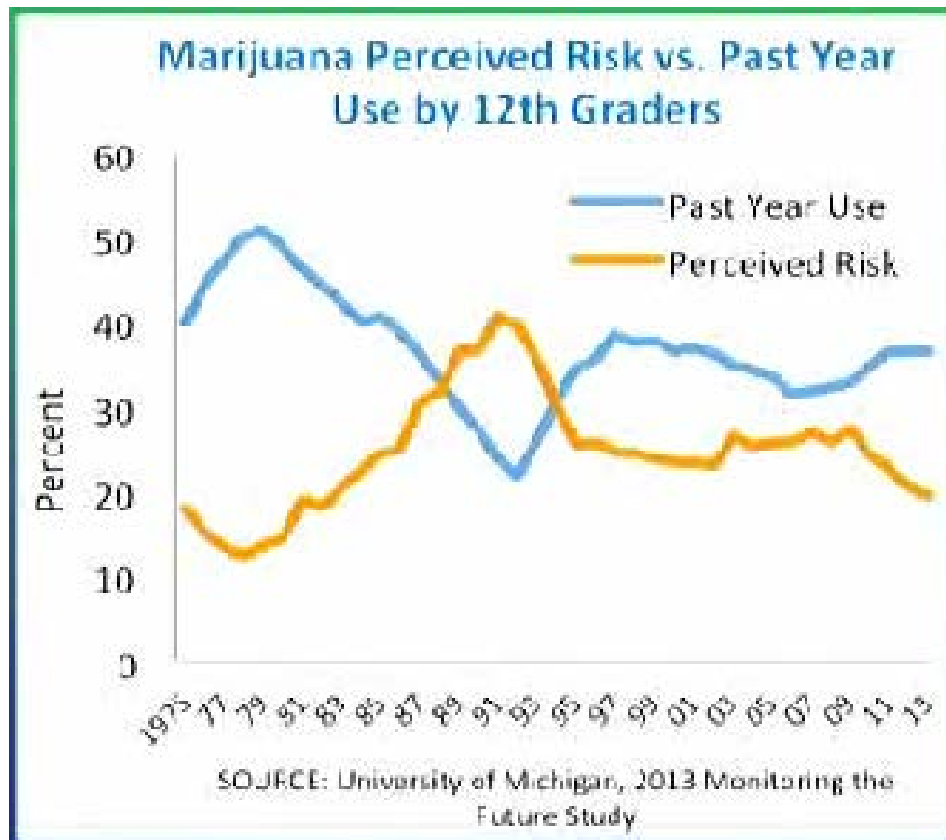
## Use of Alcohol and Cigarettes Steadily Drops While Marijuana Use Holds Steady

Between 2010 and 2015, alcohol use and cigarette use, respectively, decreased 20% and 47% among 8th, 10th, and 12th graders, while marijuana use remained unchanged.



Source: 2015 Monitoring the Future Survey, National Institute on Drug Abuse

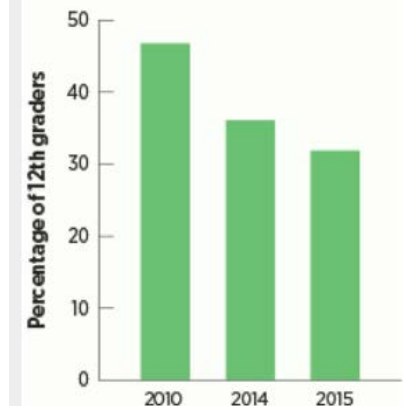
# Use Goes Up As Perceived Risk Falls (with a slight lag)



Perception of harm from Cannabis approaching all-time lows

## Perception of Marijuana as Risky Continues to Decline Among 12th Graders

About 15% fewer 12th graders viewed marijuana as risky in 2015 than in 2010.



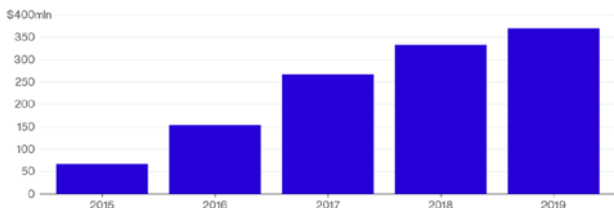
Source: 2015 Monitoring the Future Survey, National Institute on Drug Abuse

# Cannabis Use by Sales

Recreational use  
Up 88%

Where will it  
plateau?

**Washington's Cash Crop: State Reaps Marijuana Tax Windfall**  
As pot sales climb, so does state's share of the revenue



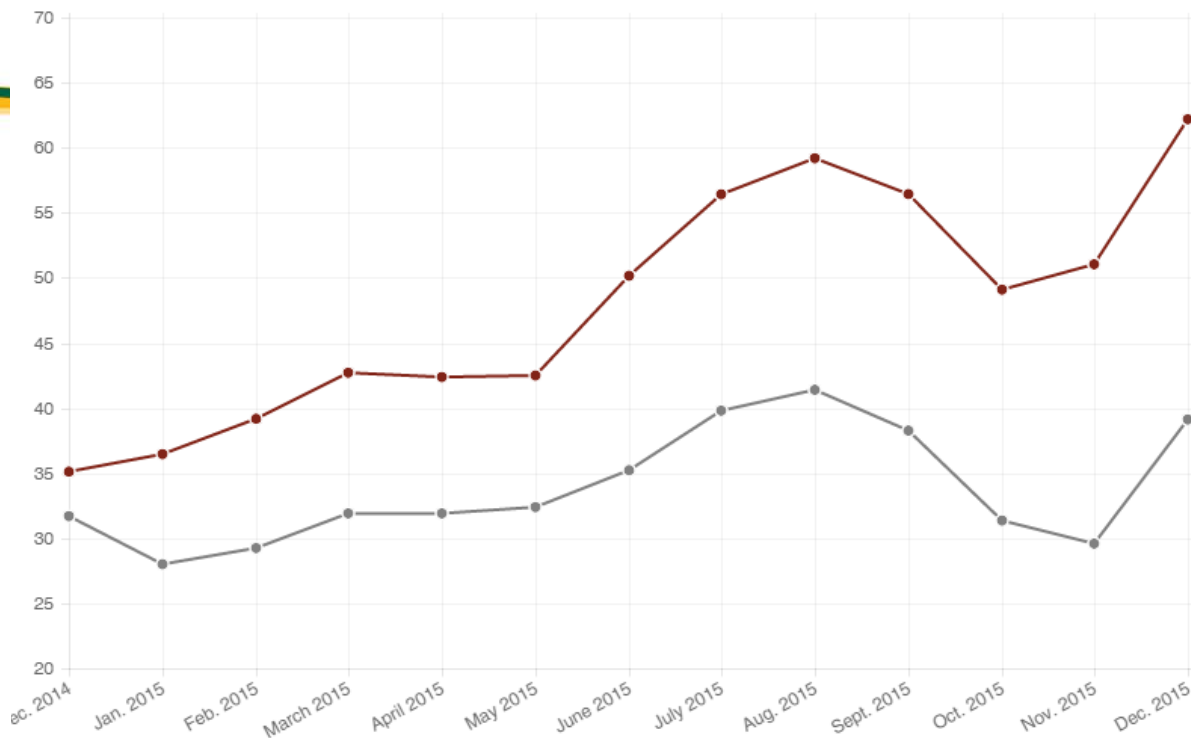
Source: Washington Economic & Revenue Forecast Council

Bloomberg



## Sales stats for Colorado weed

A month-by-month look comparing sales of recreational and medical marijuana



2015 Recreational total  
\$587,834,219

2015 Medical total  
\$408,350,569

**2015: \$996,184,788**

2014 Recreational total  
\$313,226,353

2014 Medical total  
\$385,972,452

**2014: \$699,198,805**

Source: Colorado Dept. of Revenue; graphic by Kevin Hamm, The Denver Post

# Important Considerations

- Data from states that have legalized cannabis just starting to become available
- Cannabis use staying stable in youth while use of other substances is decreasing
  - (From Monitoring the Future Study) “The use of both alcohol and cigarettes reached their lowest points since the study began in 1975. Use of several particularly dangerous illicit drugs—including MDMA (ecstasy, Molly), heroin, amphetamines and synthetic marijuana—also showed a decline this year. Marijuana use, however, remained level.”

# Abuse and Dependence





Original Investigation

# Prevalence of Marijuana Use Disorders in the United States Between 2001-2002 and 2012-2013

Deborah S. Hasin, PhD; Tulshi D. Saha, PhD; Bradley T. Kerridge, PhD; Risë B. Goldstein, PhD, MPH;  
S. Patricia Chou, PhD; Haitao Zhang, PhD; Jeessun Jung, PhD; Roger P. Pickering, MS; W. June Ruan, MA;  
Sharon M. Smith, PhD; Boji Huang, MD, PhD; Bridget F. Grant, PhD, PhD

## Key findings from major recent Oct 2015 report of face to face interviews with 80,000 adults

- Past year use up from 4.1% (2001) to 9.5% (2013)
- Use causing problems rose from 1.5% to 2.9%, mainly from new users
- 1 in 3 users have problematic use

# Cannabis Dependence and Withdrawal

- Occurs in about 9% of cannabis users (higher among teen users)
- Peaks about 2-4 days but can last up to 3 weeks after stopping
- Symptoms include restlessness, agitation, anxiety, aggression, sleep problems and strange dreams, decreased appetite

# Gateway Hypothesis

- Hypothesis that cannabis use increases likelihood of using even more dangerous drugs
- Studies that have attempted to control for potential confounds and genetic diathesis (discordant twin designs) continue to show this association (Lynskey et al., 2003, 2006)
- Newer evidence of “reverse gateway” with regard to tobacco smoking, ie cannabis use leading to tobacco use (Patton et al., 2005)

# Cannabis and Alcohol

## NATIONAL AFFAIRS

### The Real Dangers of Marijuana

*Jonathan P. Caulkins*

Author from RAND

- Cannabis “may generate 62% more abuse and dependence per current user than alcohol does.”

Jonathan P. Caulkins · *The Real Dangers of Marijuana*

#### RELATIVE RESPONSE RATES FOR MARIJUANA USERS AND ALCOHOL USERS

QUESTION (ABBREVIATED)	RELATIVE RATE
Needed to use more to get desired effect	3.3
Spent a lot of time getting or using the drug	3.2
Drug caused serious problems at home, work, or school	2.8
Took time from work/school/other important activities	2.6
Tried to limit use but failed	1.7
Tried to cut down but failed	1.6
Caused problems with emotions, nerves, or mental health	1.5
Continued use despite those problems	1.6
Drug caused problems with family or friends	1.5
Continued use despite those problems	1.7
Using same amount had less effect	1.2
Drug put you in physical danger	0.8

*Source: Author's analysis of National Household Survey data.*

# Effects of Cannabis on the Brain

A decorative graphic consisting of three thick, curved lines. A dark green line starts on the left, dips slightly, and then rises towards the right. An orange line starts below the green line, dips slightly, and then rises more steeply. A light yellow line starts below the orange line and rises steeply, crossing the other two lines as they ascend on the right side of the slide.

# Brain Cannabinoid System

- Brain has cannabinoid receptors in brain
- Anandamine is brain endocannabinoid
- Involved in
  - Brain growth
  - Myelin growth on neurons
  - Neuronal activity
  - Regulates other neurotransmitters
- Plant THC stronger and longer lasting effect than anandamine

# Cannabis Changes the Brain, Especially Young Ones

## Long-term effects of marijuana use on the brain

Francesca M. Filbey<sup>a,1</sup>, Sina Aslan<sup>a,b</sup>, Vince D. Calhoun<sup>c,d</sup>, Jeffrey S. Spence<sup>a</sup>, Eswar Damaraju<sup>c</sup>, Arvind Caprihan<sup>c</sup>, and Judith Segall<sup>c</sup>

Neurobiology of Disease

Cannabis Use Is Quantitatively Associated with Nucleus Accumbens and Amygdala Abnormalities in Young Adult Recreational Users

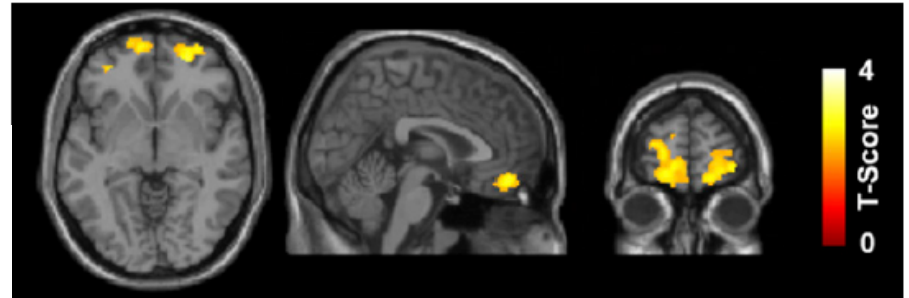


Fig. 1. Group comparison of the gray matter volume by SPM8 plus DARTEL analysis demonstrates significant reduction of gray matter volume in bi-lateral orbitofrontal gyri (AAL atlas) in marijuana users compared with controls. Right side of the image represents the right hemisphere in axial view.

*Psychological Medicine*, Page 1 of 14. © Cambridge University Press 2015  
doi:10.1017/S0033291715002342

## Effect of high-potency cannabis on corpus callosum microstructure

# Medical Marijuana

- Started as “compassionate use” in terminally ill patients
- Medical evidence quite limited, strongest for
  - Chemotherapy induced nausea and vomiting
  - Muscle spasticity in MS
  - Increasing appetite in wasting due to AIDS
- Studies often use isolated compounds taken orally and not involving smoking plant
  - Analogy with recommendation to eat moldy bread because penicillin has been isolated from mold
- Some products already on market: Marinol and Sativex



# Health Effects of Cannabis

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# Cannabis Decreases Cognitive Function

- IQ drop of 8 points from adolescence to adulthood among heavy users who started in adolescence

Persistent cannabis use was associated with neuropsychological decline broadly across domains of functioning, even after controlling for years of education. Informants also reported noticing more cognitive problems for persistent cannabis users. Impairment was concentrated among adolescent-onset cannabis users, with more persistent use associated with greater decline. Further, cessation of cannabis use did not fully restore neuropsychological functioning among adolescent-onset cannabis users. Findings are suggestive of a neurotoxic effect of cannabis on the adolescent brain and highlight the importance of prevention and policy efforts targeting adolescents.

# Cannabis Use Doubles the Risk for Psychosis

Table 1 | **General population studies of the effect of cannabis use on the risk of psychosis**

Country in which the study was conducted	Number of participants	Follow up	Odds ratio (95% confidence interval)	Study design
United States	4,494	NA	2.4 (1.2, 7.1)	Population based
Sweden	50,053	25 years	2.1 (1.2, 3.7)	Conscript cohort
The Netherlands	4,045	3 years	2.8 (1.2, 6.5)	Population based
Israel	9,724	4–15 years	2.0 (1.3, 3.1)	Population based
New Zealand (Christchurch)	1,265	3 years	1.8 (1.2, 2.6)	Birth cohort
New Zealand (Dunedin)	1,253	15 years	3.1 (0.7, 13.3)	Birth cohort
The Netherlands	1,580	14 years	2.8 (1.79, 4.43)	Population based
Germany	2,436	4 years	1.7 (1.1, 1.5)	Population based
United Kingdom	8,580	18 months	1.5 (0.55, 3.94)	Population based

NA, not applicable.

**2-fold increase**

**Morrison, Murray et al., Nature Neuroscience, 2008**

Alan Budney PhD Giesel School Of Medicine, Dartmouth

# Cannabis Use Increases Risk of Anxiety Disorders

RESEARCH ARTICLE

Open Access

A positive association between anxiety disorders and cannabis use or cannabis use disorders in the general population- a meta-analysis of 31 studies

Karina Karolina Kedzior\* and Lisa Tabata Laeber

- Meta-analysis of 31 studies encompassing over 112,00 individuals

# Cannabis Associated with Worse PTSD

- Recent study of over 2,000 veterans
- Cannabis use associated with the following
  - Worse PTSD symptoms
  - Higher aggression
  - More alcohol and drug use

**Conclusions:** In this observational study, initiating marijuana use after treatment was associated with worse PTSD symptoms, more violent behavior, and alcohol use. Marijuana may actually worsen PTSD symptoms or nullify the benefits of specialized, intensive treatment. Cessation or prevention of use may be an important goal of treatment.

Wilkinson et al., J Clin Psychiatry, 2015

# Cannabis and Driving

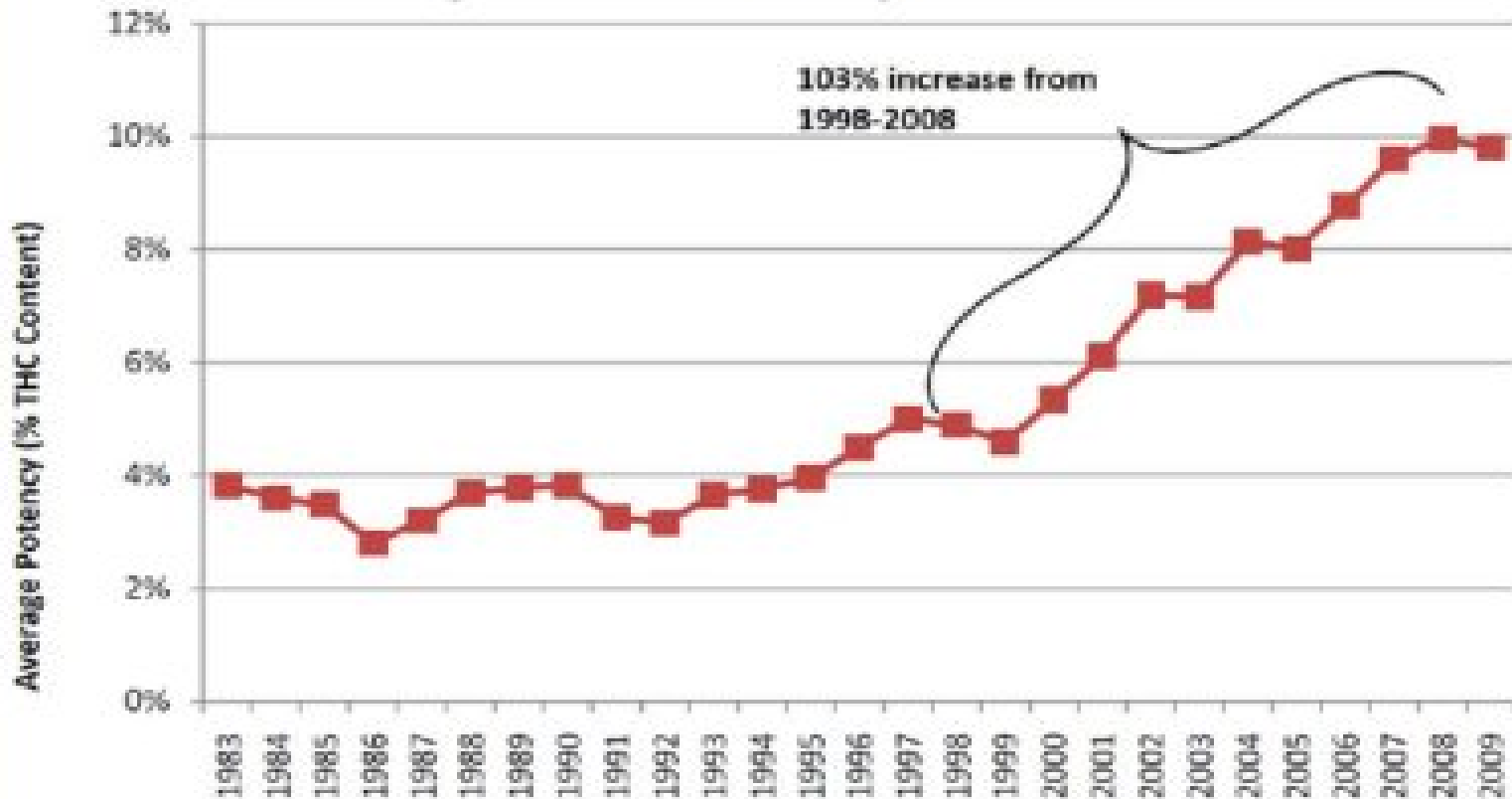
- Cannabis affects reaction time, coordination, and judgment
- Motor vehicle accident rate doubles after using cannabis, according to meta-analysis
  - Most studies of adults so youth risk could likely be higher

Ramaekers et al. Drug Alcohol Dependence, 2004

# Other Issues

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## Potency of Seized Marijuana in the U.S.



Source: University of Mississippi, National Center for Natural Products Research, Potency Monitoring Project Quarterly Report 107 (January 2010)

Many studies showing worse health effects with more potent cannabis  
Possible reason older studies underestimate risk



# What will be the effect of commercialization?



Not actual product

# WILLIE'S RESERVE



# Conclusion

- There is every reason to believe that legalizing cannabis in Vermont will have a negative effect on the public health of our state
- Whether this effect will be large or small is currently unknown
- We will have a much better idea of the magnitude of the public health impact, and may be better prepared to minimize that effect should legalization eventually occur, by waiting and carefully examining the data trends and practices of other states