Real Medicines have Real Risks

An Explanation of Marijuana's Potential Health Hazards

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Disclosures

- No connection to cannabis industry or pro-cannabis lobby
- No connection to any anti-cannabis organization
- Received $962.46 (in meals at lunch/dinner lectures) from pharmaceutical industry between 2013 to 2018
- Always signed petitions for, and voted in favor of measures to make cannabis legal
- Believe that **informed adults** should who choose to use cannabis should be free to do so legally
  - **But they should not have to learn about risk the hard way**

The ‘What’ and ‘Why’ of This Talk

Objectives

- Discuss major pharmacological actions or cannabis
- Identify cannabis’ most significant health risks
- Explain how these risks relate to cannabis pharmacology

Why?

- Because every real medicine comes with risks
- A lot of people underestimate the risks from cannabis

Underestimating Cannabis Risk

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Public Perception of Cannabis Risk Potential

- Perception of "great risk" from weekly marijuana use dropped from **50.4%** in 2002 to **33.3%** in 2014[1]
- Aside from legal problems, at least half of Americans report little concern for serious risks[2]
- **65%** of teens are **not worried** that cannabis might damage health[3]
- **30%** believe that smoking or vaping cannabis will actually prevent health problems[1]

1. Compton, W.M., Han, B., Jones, C.M., Blanco, C., and Hughes, A. (2016). Marijuana use and use disorders in adults in the USA, 2002-14: analysis of annual cross-sectional surveys. Lancet Psychiatry 3, 954–964.
2. Keyhani, S., Steigerwald, S., Ishida, J., Vali, M., Cerdá, M., Hasin, D., Dollinger, C., Yoo, S.R., and Cohen, B.E. (2018). Risks and Benefits of Marijuana Use: A National Survey of U.S. Adults. Ann. Intern. Med. 169, 282–290.
3. Wadsworth E, Hammond D: International differences in patterns of cannabis use among youth: Prevalence, perceptions of harm, and driving under the influence in Canada, England & United States. Addictive Behav 90:171-175, 2019.

Why Is Cannabis Risk Under-Appreciated?

Don't Think Much About It

- Most people don't use cannabis ➔ no strong reason to consider safety.

Turned Off By Propaganda

- To the extent that risk has been discussed, it's been in the context of "drugs are bad… just say no" prohibition campaigns ➔ messages seen as agenda-pushing and **fear-mongering**, possibly not taken seriously.

No Personal Experience of Harm

- Majority of those who have used cannabis are infrequent consumers of low-potency products ➔ many within this group will not have experienced adverse effects.

"Natural" Brand Image

- Prefixes like "recreational" or "medical" may also deflect perceived risk

Why Is Cannabis Risk Under-Appreciated?

Bias Toward Positive Experience Among Advocates

- The most motivated, vocal advocates are people for whom cannabis works really well.. Have received high benefit/low risk
- Those who have experienced adverse effects less numerous and less likely to participate in public discussion

Bad For Business

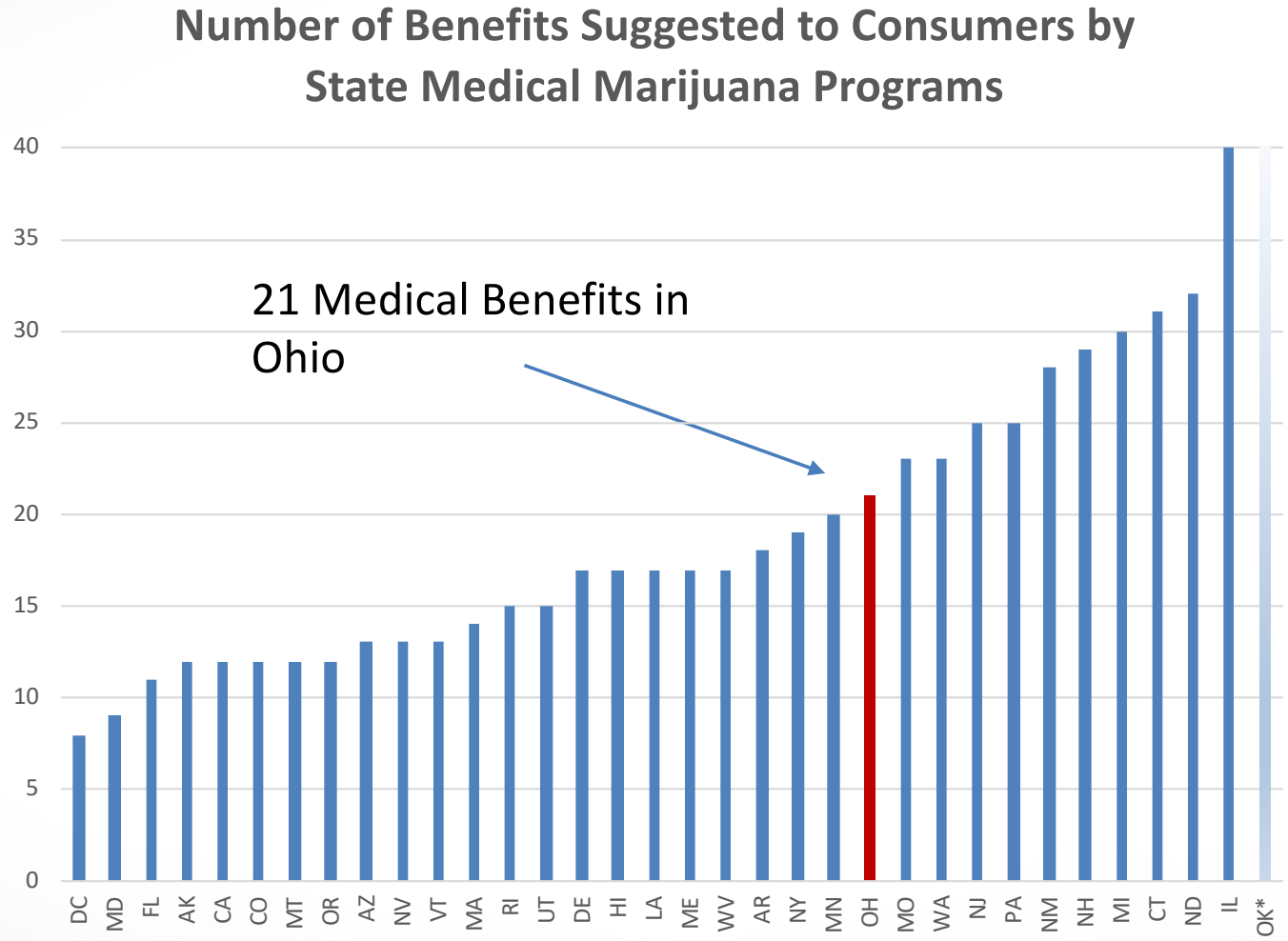
- Makes it harder to **change laws** or **sell product** to acknowledge potentially harmful risks

No Obligation to Disclose Risks

- Unlike for any other medicine, there is **no consistent regulation that requires** producers, vendors, advertisers, or recommenders to disclose risks

Most State Governments Are Silent On Possible Risks

Officially-Recognized Benefits
(Medical Benefits of Marijuana, State-By-State)



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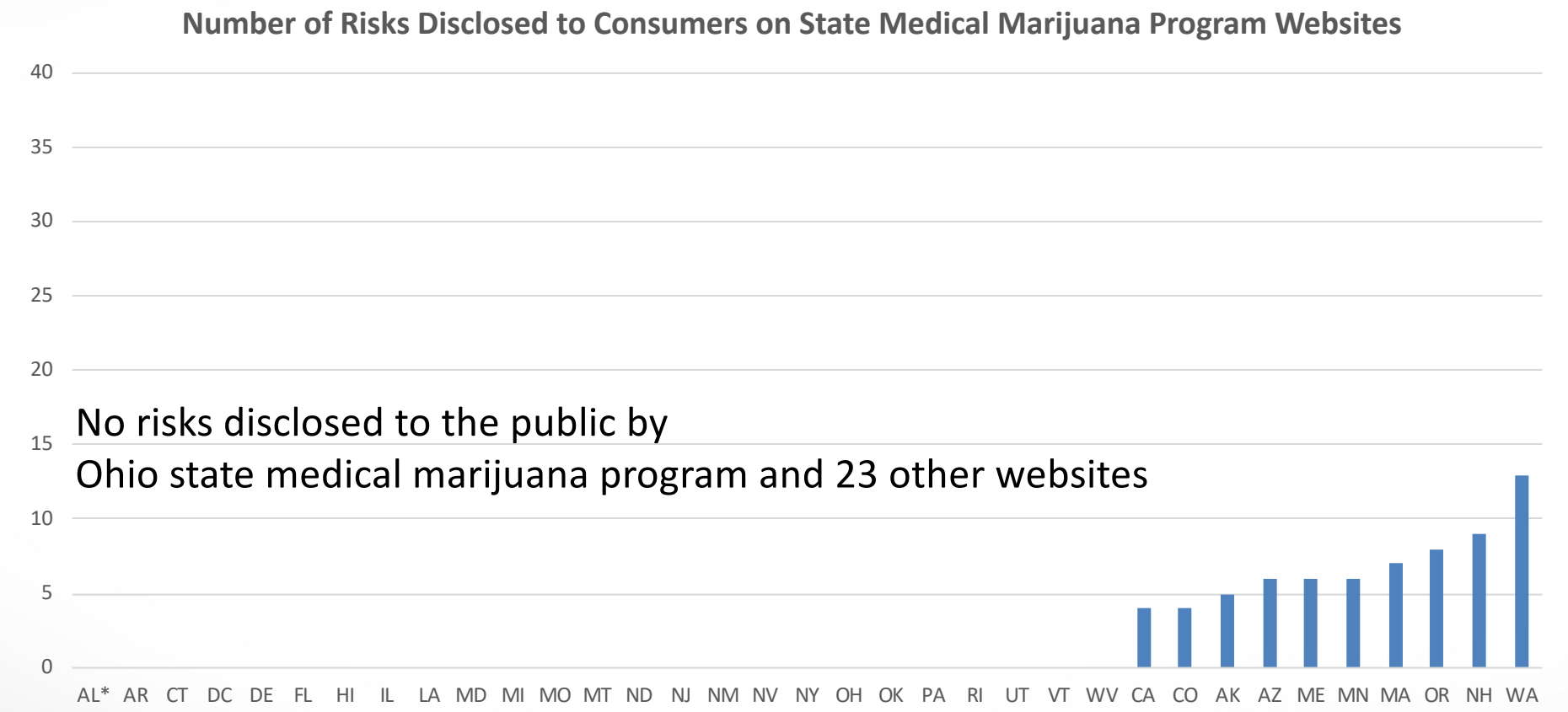
Officially-Recognized Risks
(Risks of Disclosed to the Public by State Medical Marijuana Programs)



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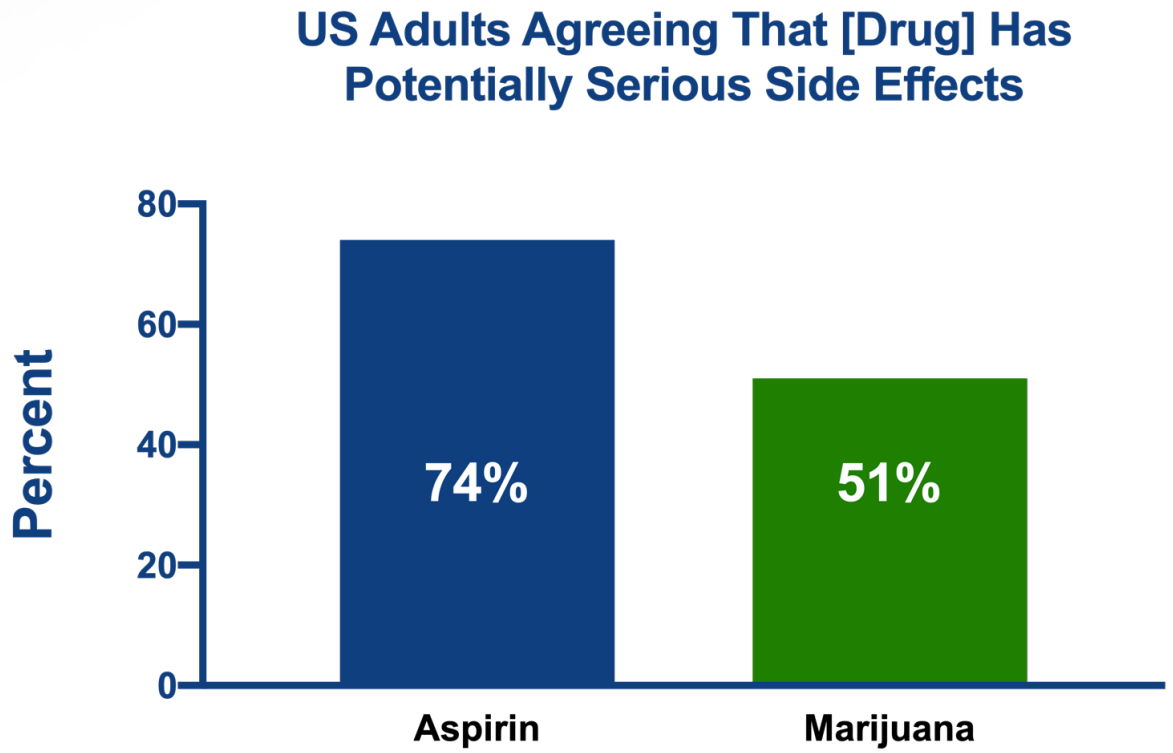
Marijuana Is Believed Safer Than Aspirin



National survey, March 2019

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How Drugs Work

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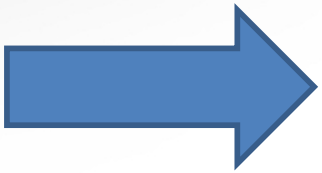
When it comes to drugs,

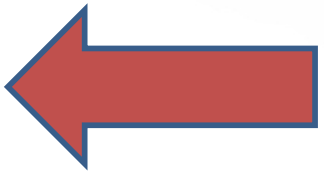
You Can't Have The Good Without Inviting The Bad…

- Drugs are molecules whose shapes allow them to distort the chemistry of life.
- Medicines are drugs that:
  1) don't usually kill us, and
  2) distort life chemistry in ways that may be useful

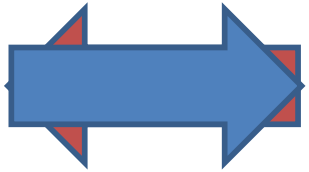
Potential Benefits are Inseparable From Risks



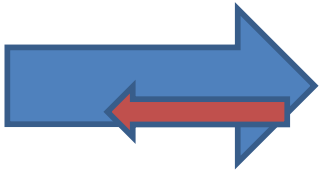
Drugs Distort Life Processes



Diseases Distort Life Processes



Medicinal Drugs Counteract Disease Distortion



But Usually Never Stop There

The body can't tell the difference between medical or recreational use

The body can't tell if a drug came from a plant or a factory

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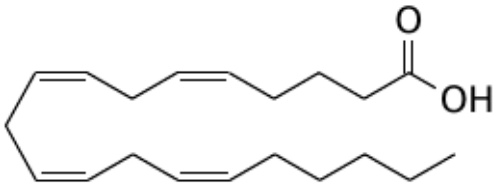
Example

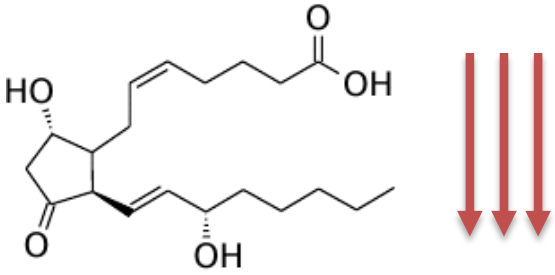
Aspirin Distorts a Fundamental Reaction

Arachidonic Acid



Cyclooxygenase Enzyme (COX)

Prostaglandin Signaling Molecules



Turns off an enzyme that converts an omega-6 fatty acid into prostaglandin chemical messenger molecules

Effects of Aspirin's Distortion

Location	Action of Prostaglandins	Effect of Reducing Prostaglandins
Nerve endings	Activate small-diameter fibers	Analgesia, pain reduction
Brain, hypothalamus	Thermoregulation	Antipyretic, fever reduction
Interstitial fluid	Recruit immune cells	Anti-inflammation
Blood cells	Cell adhesion	Decrease risk of blood clots -> heart attack, thromboembolic stroke
Colon	Cell growth	Decrease risk of polyps and certain forms of colon cancer

A single biochemical pathway interacts with a wide array of seemingly different body functions.

Other Effects of Aspirin's Distortion

Location	Action of Prostaglandins	Effect of Reducing Prostaglandins
Stomach	Mucus secretion	Occult bleeding, gastritis, ulcer, overt bleeding
Lung	Tension of muscles lining the airways	Provoke asthma attack
Blood	Cell adhesion	Bruising, increased bleeding time, hemorrhagic stroke
Brain	Regulate the release of dopamine	Psychosis

The actions of a drug that make it useful as a medicine are the same actions that make it potentially harmful.

Cannabis Pharmacology

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Definitions

Cannabis A genus of flowering plants in the family Cannabaceae. Includes *C. sativa, C. indica, C. ruderalis*

Marijuana Colloquial name for cannabis.

Hemp Cannabis with very low THC content

THC Tetrahydrocannabinol. A CB1 receptor partial agonist. The intoxicating constituent of cannabis. Historically ≈ 4% of plant weight, now > 20% strains are available

CBD Cannabidiol. A neuro-active yet non-intoxicating constituent of cannabis.

State Definitions of cannabis or marijuana may allow ***any form of THC at any concentration*** to be called cannabis, marijuana, or **medical marijuana**.

Phytocannabinoids and Endocannabinoids

- Contains about 500 chemicals
- About 60 of those chemicals are unique to Cannabaceae, and are called phytocannabinoids*
- The brain makes its own endocannabinoids*
- THC is psychoactive because it activates the receptors the brain makes to detect endocannabinoids

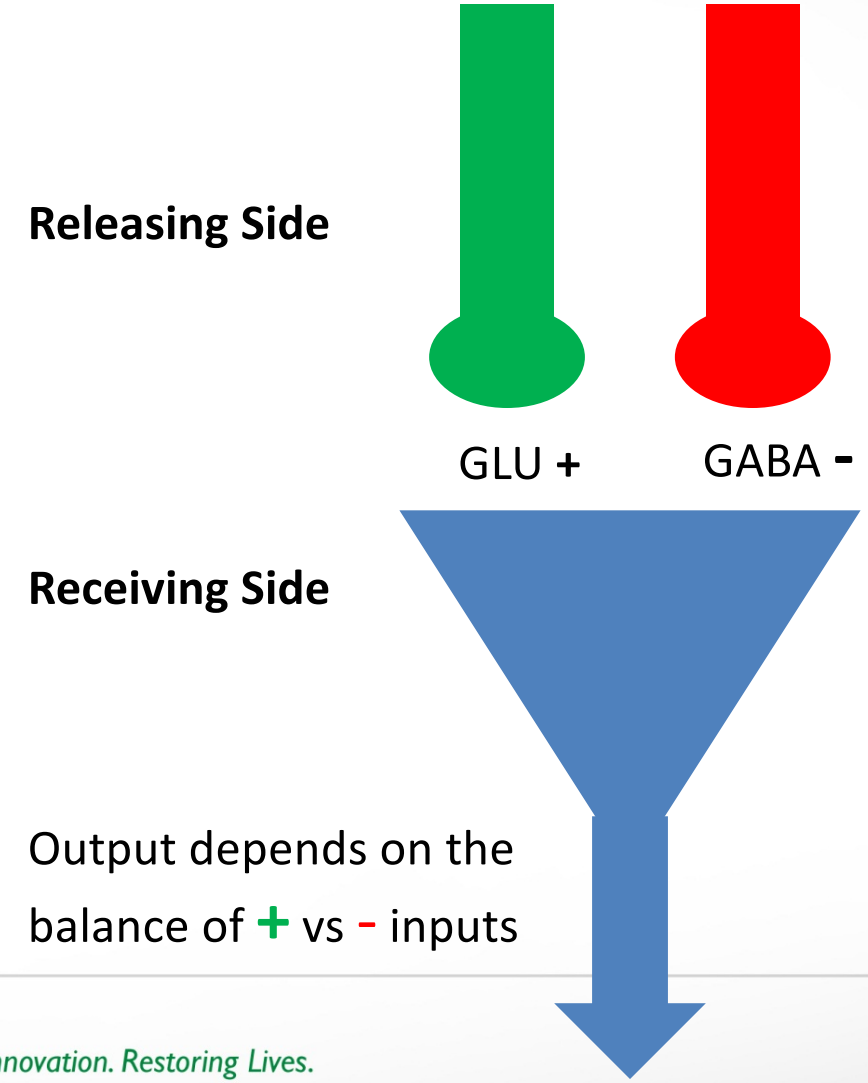
*phyto = Greek word for plant

***endo**genous cannabinoids

Neurobiology 101

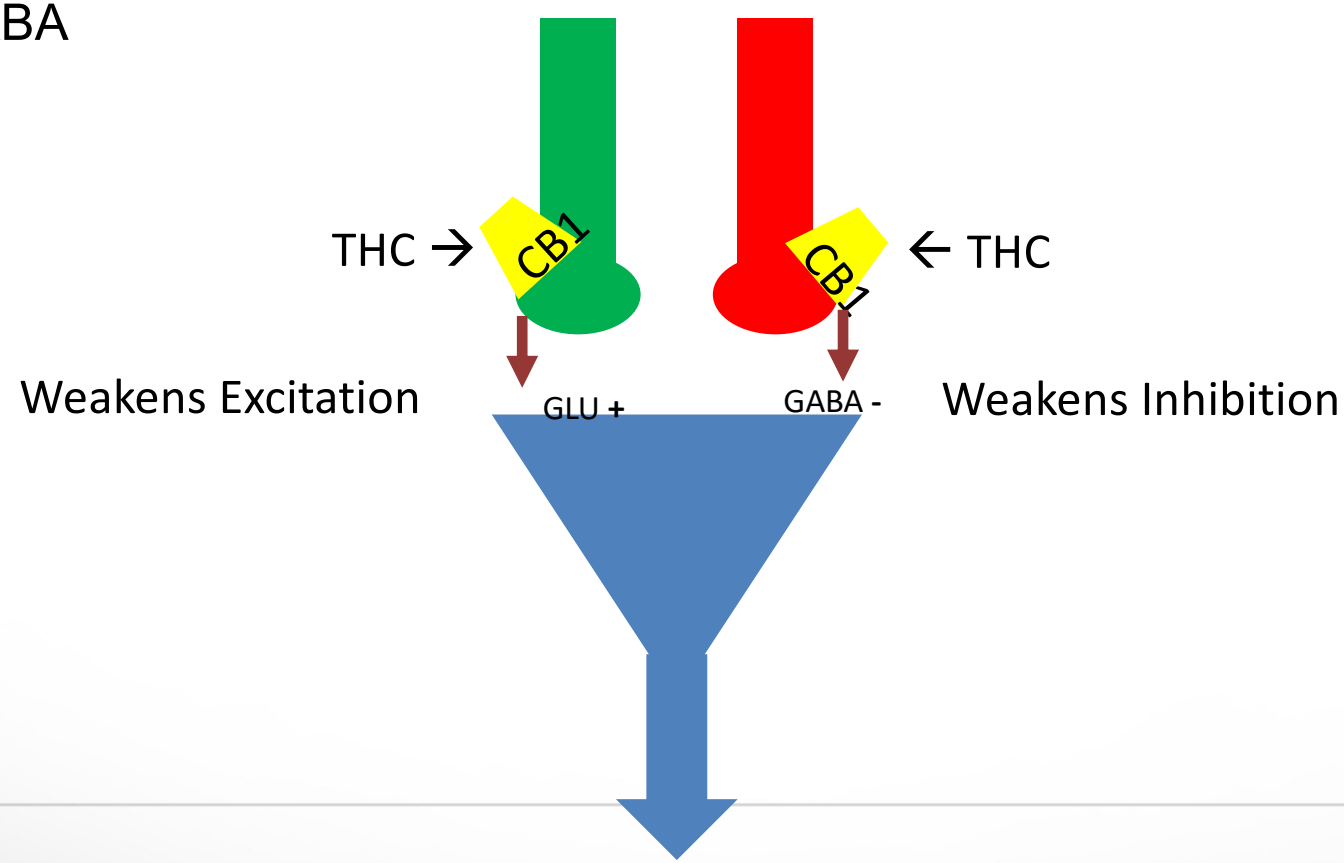
- State of consciousness, thoughts, moods, memories, decisions are based on the electrical activity of large networks of nerve cells.
- Electrical activity is regulated by chemical messages (neurotransmitters) released by activated cells at specialized points of contact (synapses).
- Neurotransmitters make receiving cells either more excitable or less excitable.

If the brain is like a computer,
This is its basic computational unit



Primary Actions of THC

- THC activates a specialized protein known as the CB1 receptor
- CB1 is located on the releasing side of the synapse
- When activated, the CB1 receptor turns down the release of glutamate or GABA



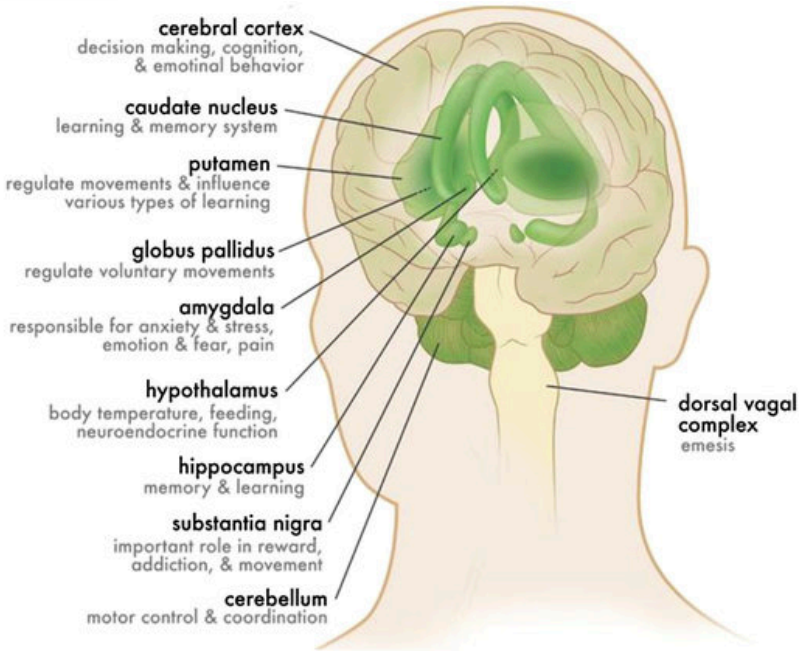
Glutamate

- Most abundant neurotransmitter in the brain. More than 50% of synapses use glutamate.
- Too much glutamate release is neurotoxic
- Just-right glutamate release is critical to sculpting the circuits that serve learning and memory
- Many anticonvulsant medications reduce the release of glutamate
- Blocking the glutamate signal can lead to dissociation or psychosis
- THC reduces glutamate output

GABA

- Second-most abundant neurotransmitter in the brain. 30% to 40% of synapses in the brain are GABA connections
- Increasing GABA signal promotes sleep, reduces anxiety, stops seizures, relaxes muscles
- Many neurological and psychiatric medications boost GABA signal
- THC reduces GABA output

Location, Location, Location



Clinical effects of THC derive from:

- Function of the brain region with CB1 receptors
- Whether net effect is to stimulate or inhibit the region
- Number and sensitivity of receptors
- Patterns of interaction between brain regions (varies between individuals)
- Genetic makeup of the individual
- Concentration of drug and rate of change of concentration

Many sites of action = Many Possible Benefits = Many Possible Risks

Endocannabinoids in Brain Development

- The endocannabinoid system is involved in the formation of the placenta[1]
- CB1 receptors in fetal brain are detected by gestational week #14 [2]
- EC system is very active in fine-tuning connections within cerebral cortex and between cortical (reasoning) and limbic (emotional) structures[3]

1. Correa, F., Wolfson, M.L., Valchi, P., Aisemberg, J., and Franchi, A.M. (2016). Endocannabinoid system and pregnancy. Reproduction 152, R191–R200.
2. Fride, E., Gobshtis, N., Dahan, H., Weller, A., Giuffrida, A., and Ben-Shabat, S. (2009). The endocannabinoid system during development: emphasis on perinatal events and delayed effects. Vitam. Horm. 81, 139–158.
3. Meyer, H.C., Lee, F.S., and Gee, D.G. (2018). The Role of the Endocannabinoid System and Genetic Variation in Adolescent Brain Development. Neuropsychopharmacology 43, 21–33.

Cannabis Risks

Several Opportunities for Risk

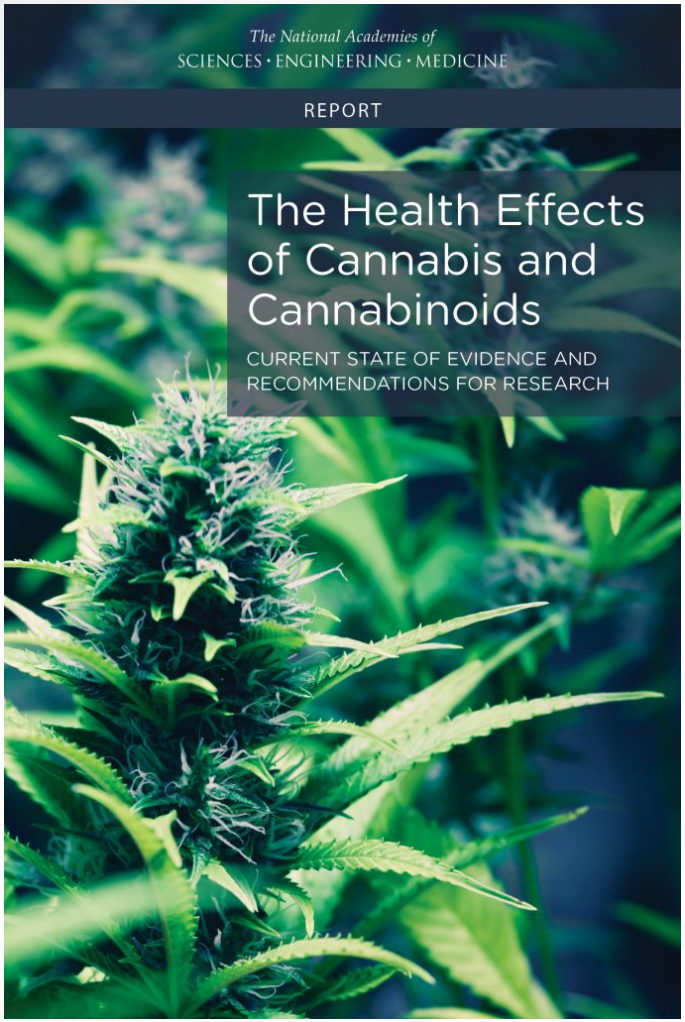
- THC disrupts the strength of the brains #1 and #2 neurotransmitter signals
- CB1 receptors are present in brain regions that control perception, mood, memory, coordination, nausea, reward
- Endocannabinoid system is present from embryonic stage of development and is active in sculpting brain development throughout childhood and adolescence

Who Decides Which Possible Benefits or Risks Are Credible?

- FDA usually makes these decisions, but is not involved in this facet of cannabis debate.
- In 1 year in the US, between **$10 billion to $30 billion is spent on cannabis**[1]
- High incentive for businesses, investors, entrepreneurs to enter this market
- Spending on political lobbying **rose by 3,400%** from 2014 to 2018[2]
- Numerous conflicts of interest at play

1. Davenport SS , Caulkins JP: Evolution of the United States marijuana market in the decade of liberalization before full legalization. J Drug Issues 46:411–427, 2016
2. Center for Responsive Politics https://www.opensecrets.org/lobby/clientsum.php?id=D000027382

Independent, Non-Partisan Review



- National Academies of Sciences, Engineering and Medicine
- Congressionally-chartered to provide objective analysis of complex problems
- Considered more than 10,700 studies for inclusion
- Published in 2017
- Full text available at https://www.nap.edu/read/24625/chapter/1

National Academies Assessment of Medical Benefits

Condition	Level of Evidence to Support Conclusion
Chronic pain in adults	Conclusive
Nausea or vomiting caused by chemotherapy	Conclusive
Patient-reported muscle spasms from multiple sclerosis	Conclusive
Sleep disturbances in obstructive sleep apnea	Moderate
Fibromyalgia, chronic pain	Moderate
Multiple sclerosis	Moderate

Conclusive Evidence:

"Strong evidence from randomized controlled trials to support the conclusion that cannabis or cannabinoids are an effective treatment."

Moderate Evidence:

"There is some evidence to support the conclusion that cannabis or cannabinoids are an effective treatment."

Conclusions About Medical Benefits National Academies v State of Ohio

Conditions with at least moderate evidence per National Academies of Sciences, Engineering and Medicine

Chronic pain

Nausea or vomiting

Multiple sclerosis

Sleep disturbances in OSA

Fibromyalgia

Medical Uses Approved by the State of Ohio

AIDS

Amyotrophic lateral sclerosis

Alzheimer's disease

Cancer

Chronic traumatic encephalopathy

Seizure disorders

Fibromyalgia

Glaucoma

Hepatitis C

Inflammatory bowel disease

Multiple sclerosis

Chronic pain

Parkinson's disease

HIV Positive

PTSD

Sickle cell anemia

Spinal cord disease or injury

Tourette's syndrome

Traumatic brain injury

Ulcerative colitis

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National Academies Assessment of Risks

Condition	Level of Evidence to Support Conclusion
Respiratory symptoms, bronchitis (if smoked)	Substantial
Increased risk of motor vehicle accidents	Substantial
Lower birth weight of babies if cannabis used in pregnancy	Substantial
Development of schizophrenia or other psychoses	Substantial
Problematic cannabis use (e.g., addiction)	Substantial

Substantial Evidence:

"Several supportive findings from good-quality studies with very few or no credible opposing findings"

National Academies Assessment of Risks

Condition	Level of Evidence to Support Conclusion
Accidental overdose in children	Moderate
Impairments of learning, memory, or attention	Moderate
Increased symptoms of mania in setting of bipolar disease	Moderate
Increased risk of developing depressive disorders	Moderate
Increased incidence of suicidal ideation or attempts	Moderate
Increased incidence of social anxiety disorder	Moderate
Worsening of the negative symptoms of schizophrenia	Moderate
Development of an other-than-cannabis substance use disorder	Moderate

Moderate Evidence:

"Several supportive findings from good- to fair-quality studies with very few or no credible opposing findings"

Risks Publicized by the Government of Canada

Example of **FRONT (principal display panel)** with solid coloured background and brand/producer logo

Marijuana Packaging in Canada is required to carry warnings about:

- Lung health
- Pregnancy risks
- Vehicle accidents
- Addiction risks
- Increased risk for psychosis or schizophrenia
- Special vulnerability of adolescents

Full list of required warnings:
https://www.canada.ca/en/health-canada/services/drugs-medication/cannabis/laws-regulations/regulations-support-cannabis-act/health-warning-messages.html

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THC Adverse Effects from USA Clinical Trials

- Exacerbates mania, depression or schizophrenia
- Paranoid reaction, abnormal thinking, hallucination (ie, psychosis)
- Impaired cognition
- Impairs mental/physical activities required for complex taks (like driving)
- Blood pressure, pulse effects
- Seizures and seizure-like activity
- Paradoxical nausea, vomiting or abdominal pain

Marinol (dronabinol, THC) prescribing information
https://www.accessdata.fda.gov/drugsatfda_docs/label/2017/018651s029lbl.pdf

CBD Adverse Effects from USA Clinical Trials

Per FDA Prescribing Information for Epidiolex:

Warnings

- Hepatocellular injury
- Somnolence and sedation
- Suicidal behavior and ideation

> 10% prevalence

- Somnolence
- Decreased appetite
- Diarrhea
- Transaminase elevations
- Fatigue
- Malaise
- Asthenia
- Rash
- Insomnia
- Sleep disorder
- Poor quality sleep
- Infections

Other CNS Effects

- Irritability, agitation
  - 5% to 9% for CBD
  - 2% for placebo
- Aggression, anger
  - 3% to 5% for CBD
  - < 1% for placebo
- Drooling
  - 1% to 4% for CBD
  - < 1% for placebo
- Gait disturbance
  - 2% to 3% for CBD
  - <1% for placebo

Cannabinoid Hyperemesis Syndrome

- Severe, intractable, frequent episodes of abdominal pain, nausea, vomiting
- Affected people find relief from hot showers, baths
- Can be life threatening (and there have been fatalities) due to complications from repetitive vomiting
- Occurs in long-term, regular cannabis users
- “New disorder” first described in 2014

Cannabinoid Hyperemesis Syndrome

- Ibn Wahshiyah, Arabic physician, 1000 AD described “continuous wretching and death” among hashish users
- THC prescribing information describes paradoxical abdominal pain, nausea, vomiting
- CB1 receptors in brainstem regulate nausea/vomiting. They change in number and density with long-term cannabis use.

How Big Is The Risk?

- Cyclical vomiting diagnoses doubled in Colorado within 2 years of the 2009 liberalization of cannabis laws (Kim, 2015, Acad Emerg Med 22:694-9)
- 7-fold higher likelihood that a diagnosis of persistent vomiting is present among people with a cannabis use disorder (Patel, 2019, Psychosomatics doi: 10.1016/j.psym.2019.07.003)
- 30% of daily or near-daily cannabis users reported CHS-like symptoms in a survey conducted in New York City (Habboushe, 2018, Basic Clin Pharmacol Toxicol 122:660-2)

The Important Lessons of CHS

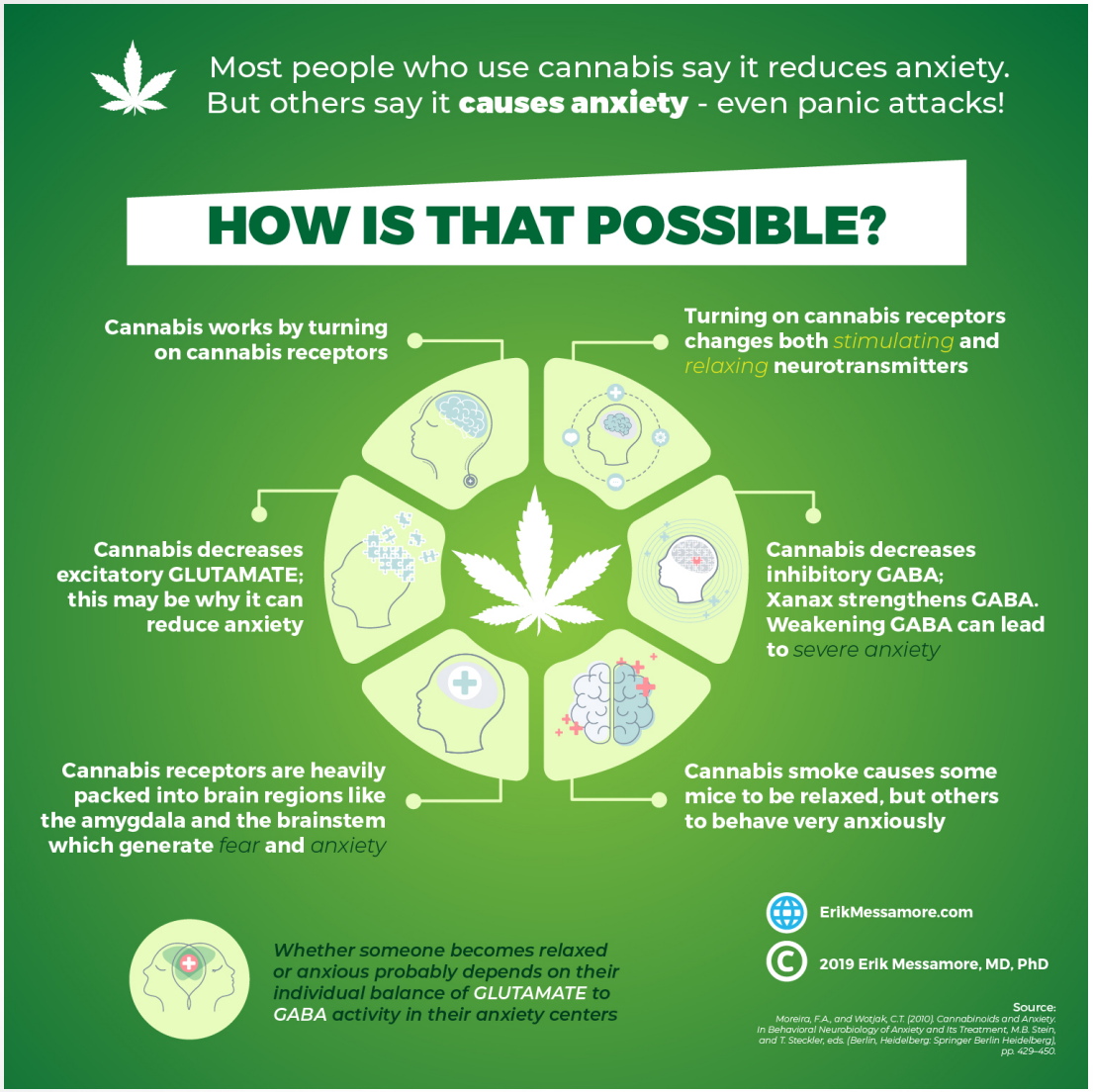
- Like many other medications, marijuana can have paradoxical effects
- Risk profile can change over time
- There are some problems with the talking point that ‘we know all about cannabis risk because people have been using it for 5,000 years’

Most Common Adverse Effects in New Zealand Survey

- Community survey of 1,000 adults (18 – 35 years old)
- 38% reported having used cannabis
- Most common adverse effects
  - Anxiety or panic attacks (22%)
  - Psychotic symptoms (15%)

Thomas, H. (1996). A community survey of adverse effects of cannabis use. Drug and Alcohol Dependence 42, 201–207.

How Can Cannabis Cause Anxiety?



THC activates CB1 receptor

Activated CB1 receptor turns down GABA release

GABA inhibits activity within anxiety centers in the brain

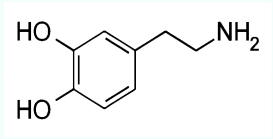
Reducing GABA signal can activate brain's anxiety centers

How Can Cannabis Cause Psychosis?

The Chemical Effects of Cannabis resemble the Biochemistry of Psychosis

Cannabis triggers dopamine release.[1]

Most people with psychosis or schizophrenia release too much dopamine.

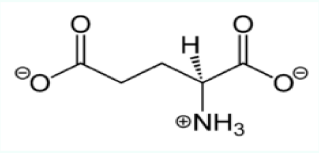


DOPAMINE

Dopamine is a chemical signal for significance. Misperceiving significance can lead to psychosis.

Cannabis reduces glutamate release.[2]

Many people with psychosis or schizophrenia have weak glutamate signals.

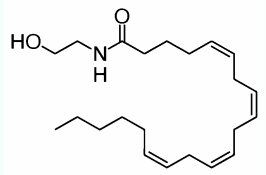


GLUTAMATE

Glutamate is the brain's most abundant neurotransmitter. It's especially important in the networks that form perceptions. Other drugs that reduce glutamate signals (like ketamine or PCP) can produce psychosis.

Cannabis reduces the level of protective anandamide.[3]

Low anandamide levels correspond to more severe symptoms of psychosis in people with schizophrenia.[4]

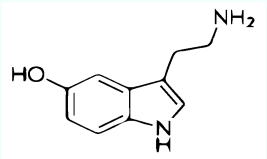


ANANDAMIDE

Named after the Sanskrit word for bliss, anandamide reduces brain inflammation and protects the brain against schizophrenia.

Frequent exposure makes the hallucination-producing 2A-type of serotonin receptor more sensitive.[5]

Many people with schizophrenia have abnormal 2A-type seratonin receptors.



SEROTONIN

Serotonin is part of the brain circuits that create perception. Drugs like LSD or psilocybin produce their hallucinations by turning on the 2A-type of serotonin receptor.

Sources:

1. Bloomfield, M. A. P., Ashok, A. H., Volkow, N. D. & Howes, O. D. The effects of Δ9-tetrahydrocannabinol on the dopamine system. Nature 539, 369–377 (2016).
2. Sánchez-Blázquez, P., Rodríguez-Muñoz, M. & Garzón, J. The cannabinoid receptor 1 associates with NMDA receptors to produce glutamatergic hypofunction: implications in psychosis and schizophrenia. Front Pharmacol 4, 169 (2014).
3. Morgan, C. J. A. et al. Cerebrospinal fluid anandamide levels, cannabis use and psychotic-like symptoms. The British Journal of Psychiatry 202, 381–382 (2013).Koethe, D. et al.
4. Anandamide elevation in cerebrospinal fluid in initial prodromal states of psychosis. Br J Psychiatry 194, 371–372 (2009).
5. Ibarra-Lecue, I. et al. Chronic cannabis promotes pro-hallucinogenic signaling of 5-HT2A receptors through Akt/mTOR pathway. Neuropsychopharmacology 43, 2028–2035 (2018).

Findings Consistent With Causality

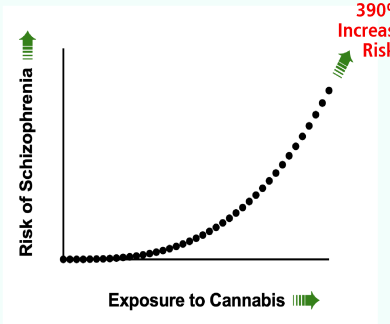
Cannabis Causes Schizophrenia-Like Changes in Animals

Giving THC to animals changes their:

- Emotional response
- Social behavior
- Motivation
- Activity
- Brain function

In ways that resemble schizophrenia in people.[6]

Schizophrenia Risk Goes up with More Frequent Cannabis Use



Based on 10 separate studies, frequent cannabis users have nearly 4 times greater risk for schizophrenia.[7]

Cannabis Causes Schizophrenia-Like Changes in People

THC causes psychosis in healthy human beings and usually worsens symptoms in people with schizophrenia.[8]

Canadian Warning Label

The government of Canada requires this health warning on all cannabis packages.[9]

Sources:
6. Renard, J., Rushlow, W. J. & Laviolette, S. R. What Can Rats Tell Us about Adolescent Cannabis Exposure? Insights from Preclinical Research. Can J Psychiatry 61, 328–334 (2016).
7. Marconi, A., Di Forti, M., Lewis, C. M., Murray, R. M. & Vassos, E. Meta-analysis of the Association Between the Level of Cannabis Use and Risk of Psychosis. Schizophr Bull 42, 1262–1269 (2016).
8. Sherif, M., Radhakrishnan, R., D'Souza, D. C. & Ranganathan, M. Human Laboratory Studies on Cannabinoids and Psychosis. Biol. Psychiatry 79, 526–538 (2016).
9. https://www.canada.ca/en/health-canada/services/drugs-medication/cannabis/laws-regulations/regulations-support-cannabis-act/health-warning-messages.html

Pregnancy Concerns

Increased risk of:[1]

- Low birth weight (less than 5.5 lbs) (OR: 1.7)
- Small for gestational age (OR: 2.2)
- Admission to the NICU (OR: 2.0)

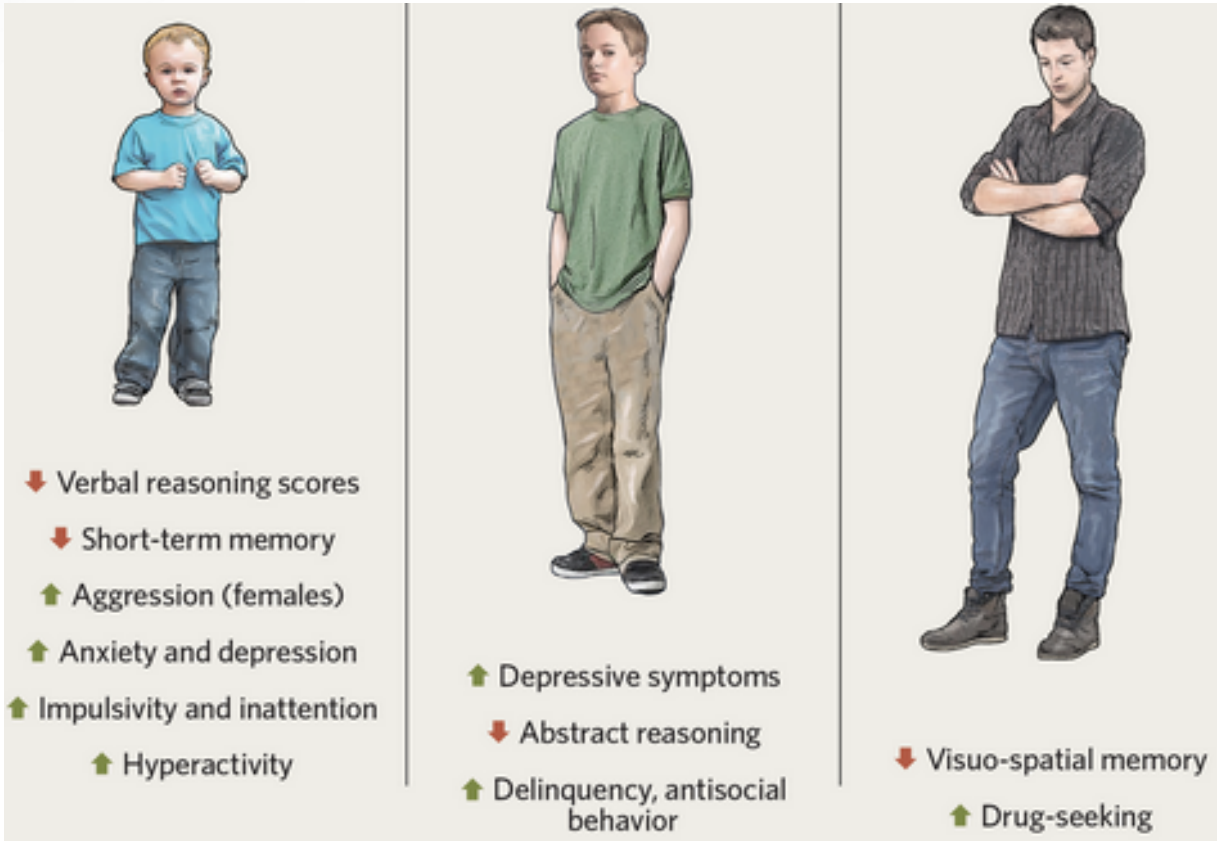
Lower levels of dopamine receptors in the fetal brain:[2]

Psychosis-prone thinking in children exposed to cannabis *in utero*[3]

1. Hayatbakhsh, M.R., Flenady, V.J., Gibbons, K.S., Kingsbury, A.M., Hurrion, E., Mamun, A.A., and Najman, J.M. (2012). Birth outcomes associated with cannabis use before and during pregnancy. Pediatric Research 71, 215–219.
2. Wang, X., Dow-Edwards, D., Anderson, V., Minkoff, H., and Hurd, Y.L. (2004). In utero marijuana exposure associated with abnormal amygdala dopamine D2 gene expression in the human fetus. Biol. Psychiatry 56, 909–915.
3. Fine, J.D., Moreau, A.L., Karcher, N.R., Agrawal, A., Rogers, C.E., Barch, D.M., and Bogdan, R. (2019). Association of Prenatal Cannabis Exposure With Psychosis Proneness Among Children in the Adolescent Brain Cognitive Development (ABCD) Study. JAMA Psychiatry.

Pregnancy Concerns

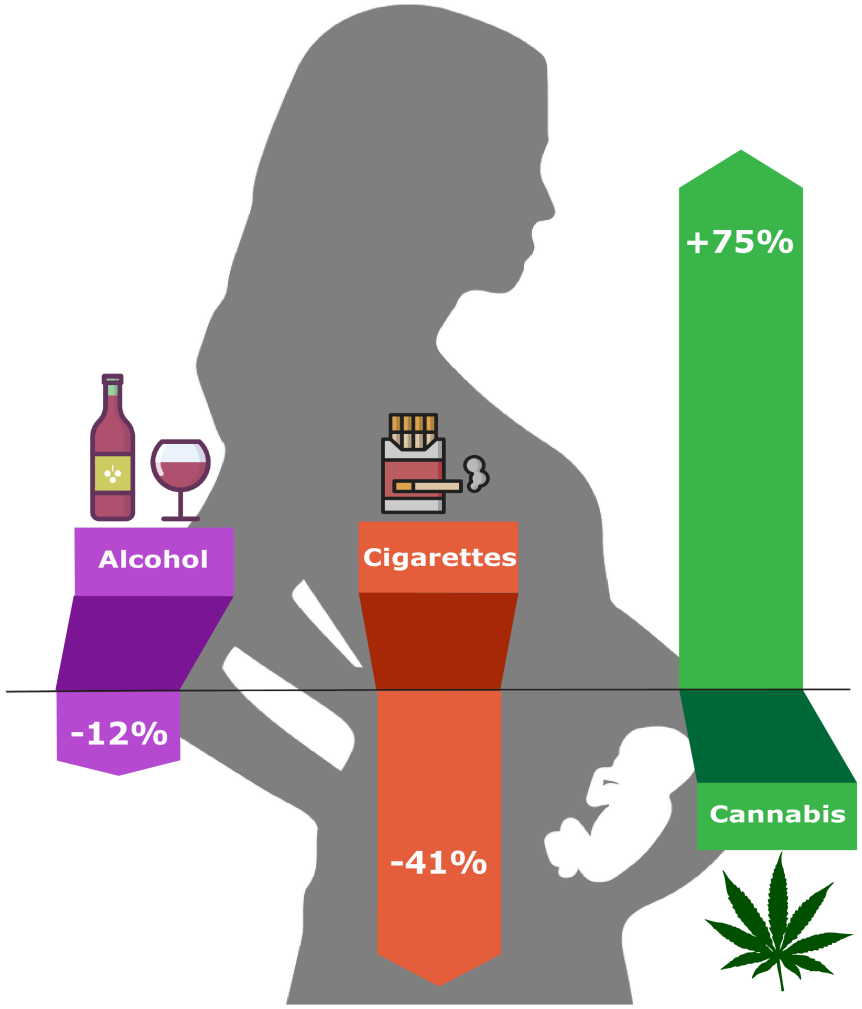
Longitudinal studies of children exposed to cannabis in utero find:



https://www.the-scientist.com/features/prenatal-exposure-to-cannabis-affects-the-developing-brain-65230

Pregnancy Concerns

Substance Use During Pregnancy US Data: 2002 - 2016



Source: Agrawal, A., et al. (2018). Alcohol, Cigarette, and Cannabis Use Between 2002 and 2016 in Pregnant Women From a Nationally Representative Sample. JAMA Pediatr.

Based on data from the National Survey on Drug Use and Health

70% of dispensaries in Colorado recommended cannabis for pregnant women with nausea; less than a third recommended checking with their doctor first

Dickson (2018) Obstet Gynecol 131:1031-1038

Cannabis Use Disorder

- Describes problematic relationship to cannabis, usually involving difficulty in controlling or cutting down use and/or using cannabis in situations where its use is causing problems
- May develop biochemically (effects on brain's reward system) or psychologically (as a coping strategy)
- Among people who have used cannabis in the prior year, 12% to 30% will meet criteria for cannabis use disorder (Hasin, 2016, JAMA Psychiatry 72:1235-42)
- Among adolescents, 20% of those who try marijuana will meet CUD criteria within 3 years (Han, 2018, Addiction 114:698-707)

Depression and Suicide

- THC depletes serotonin levels in brain regions involved in mood (rodent study: Sagredo (2006) Naunyn Schmied Arch Pharmacol 372:313-7)
- THC reduces the serotonin-boosting effect of antidepressant medication (Rodent study. Kleijn (2011) Neurosci Res 70:334-7).
- Cannabis users with depression have poorer rates of treatment response (Bahorik (2018) J Affect Disord 241:8-14)
- 62% higher risk of depression among regular cannabis consumers (Lev-Ran (2014) Psychol Med 44:797-810)
- 250% higher risk of suicide among cannabis consumers (Borges (2016) J Affect Disord 195:63-74)

Health Risks Disclosed to Ohio Medical Marijuana Consumers

- 21 benefits, zero risks described on the Ohio Medical Marijuana Program Website
- Package warnings:
  - This product may cause impairment and may be habit forming
  - There may be health risks associated with consumption of this product
  - Should not be used by women who are pregnant of breastfeeding
  - Marijuana can impair concentration, coordination and judgment. Do not operate a vehicle or machinery under the influence of this drug

http://codes.ohio.gov/oac/3796:6-3-09

But Medical Marijuana Is Safer

Ohio Definition of Medical Marijuana

"Marihuana" means all parts of a plant of the genus cannabis, whether growing or not; the seeds of a plant of that type; the resin extracted from a part of a plant of that type; and **every compound, manufacture, salt, derivative**, mixture, or preparation of a plant of that type or of its seeds or resin.

http://codes.ohio.gov/orc/3719.01v1

As with many other medical marijuana state laws,

- The only thing that defines medical marijuana is the intention of the user
- No regulation of THC/CBD ratios
- Many extremely unnatural forms of THC are included
- FDA max dose of THC 20 mg/day
- Ohio purchase limit of THC: 110 mg/day (oral) to 590 mg/day (vaping)

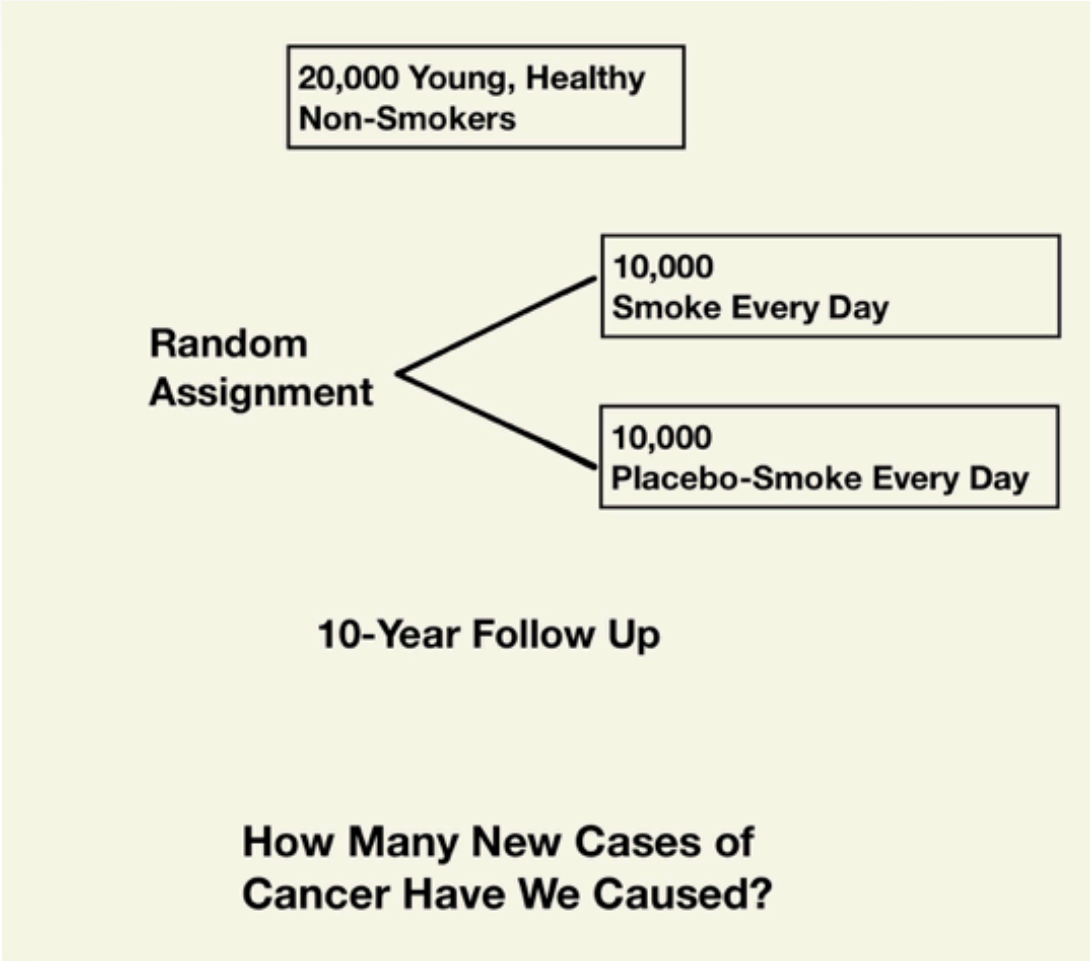
Obfuscating Risk

Discrediting Risk Is (Superficially) Easy

- "If this were true, we would have already known about it because people have used cannabis for thousands of years"
- "Correlation does not prove causation"
- "Existing data are inconclusive… we need more studies before we can say that the risk is real"

Points 2 and 3 were widely used by the tobacco industry to dispute cancer risk data

The Conclusive Study



Obviously, can never be done

Questions To Ask

- Is there a biochemical mechanism that can explain the identified risk?
- Can we create the adverse effect by giving the drug to animals?
- Can we create the adverse event in human volunteers under laboratory conditions?
- Is the event more likely among people with greater exposure to the drug?
- What's the harm in warning people about the possibility?
- How might the person/organization making the claim benefit from others believing it?

Final Words

- Any drug with medicinal value automatically carries the possibility that some who use it will be harmed.
- Modern **regulations require** the people who make, sell, or recommend drugs to disclose risks.
- **Ethics** dictate that consumers be informed of risks.
- **Prudence** requires that we err on the side of caution when deploying marijuana policy reform.
- States that adopt medical marijuana programs should **disclose and publicize** the scientifically-credible risks.

For printable PDFs of slides or infographics

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