

TRANSPORTATION RESEARCH BOARD

Driving Toward the Truth - Dispelling the Myths About Cannabis Products

February 10, 2021

**@NASEMTRB
#TRBwebinar**



PDH Certification Information:

- 1.5 Professional Development Hour (PDH) – see follow-up email for instructions
- You must attend the entire webinar to be eligible to receive PDH credits
- Questions? Contact Reggie Gillum at RGillum@nas.edu

The Transportation Research Board has met the standards and requirements of the Registered Continuing Education Providers Program. Credit earned on completion of this program will be reported to RCEP. A certificate of completion will be issued to participants that have registered and attended the entire session. As such, it does not include content that may be deemed or construed to be an approval or endorsement by RCEP.



REGISTERED CONTINUING EDUCATION PROGRAM

#TRBwebinar

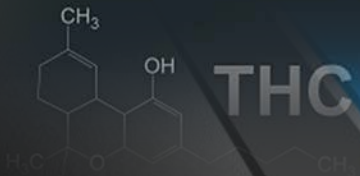
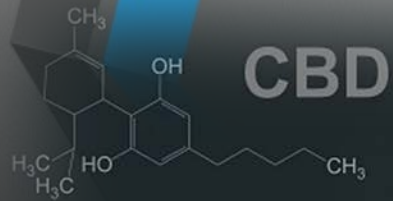
Learning Objectives

1. Identify impacts of the Farm Bill on use of THC and CBD products
2. Describe the toxicology of THC and CBD products
3. Discuss how THC and CBD products affect driving performance and crash risk

#TRBwebinar



TRB Standing Committee on Impairment in Transportation (ACS50)



TRB Webinar: Driving Toward the Truth - Dispelling the Myths About Cannabis Products



Dr. Barry K. Logan
Executive Director, Center for
Forensic Science Research
and Education (CFSRE); Senior
Vice President of Forensic
Sciences, and Chief Scientist
at NMS Labs



Michelle Peace, Ph.D.
Associate Professor and PI,
Laboratory for Forensic
Toxicology Research
Department of Forensic
Science, Virginia
Commonwealth University



**Dr. Darrin Grondel Vice
President, Government
Relations and Traffic Safety,
Foundation for Advancing
Alcohol Responsibility**



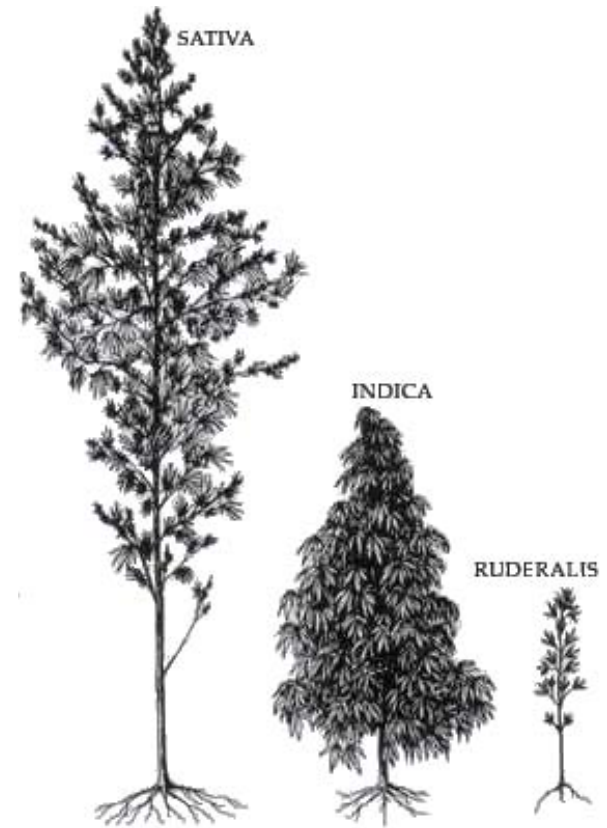
National Perspective and the Rules around CBD and THC Products and the Impacts of the Farm Law.

Barry K Logan PhD, F-ABFT



Cannabis

- Cannabis used ~5000 yrs for euphoric & therapeutic effects
- Marijuana, hashish, sinsemilla...
- >500 chemicals & at least 109 cannabinoids:
- Ratios of cannabinoids & potency vary based on age, geographical origin, strain & method of cultivation

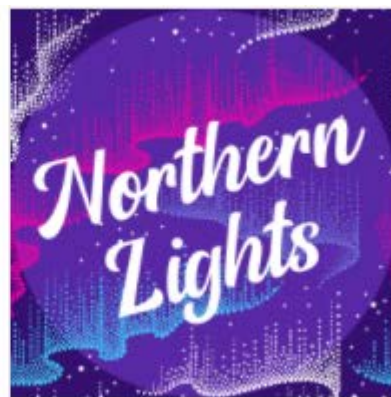




Cannabis Strains

- Cultivars, strains, varieties

-



- e.g Fruity, earthy, citrus, earthy, woody, smooth, sweet, etc
- Cannabinoids
- Terpenes
- Flavonoids



<https://www.wikileaf.com/strains/>



Cannabis Profile

- Major Cannabinoids (Examples)

Major Cannabinoids
CBG (Cannabigerol)
Delta-9-Tetrahydrocannabinol (Delta-9-THC)
Delta-8-Tetrahydrocannabinol (Delta-8-THC)
CBD (Cannabidiol)
CBC (Cannabichromene)
CBGV (Cannabigerovarin)
THCV (Tetrahydrocannabivarin)
CBDV (Cannabidivarin)
CBCV (Cannabichromevarin)
THCP (Tetrahydrocannabiphorol)
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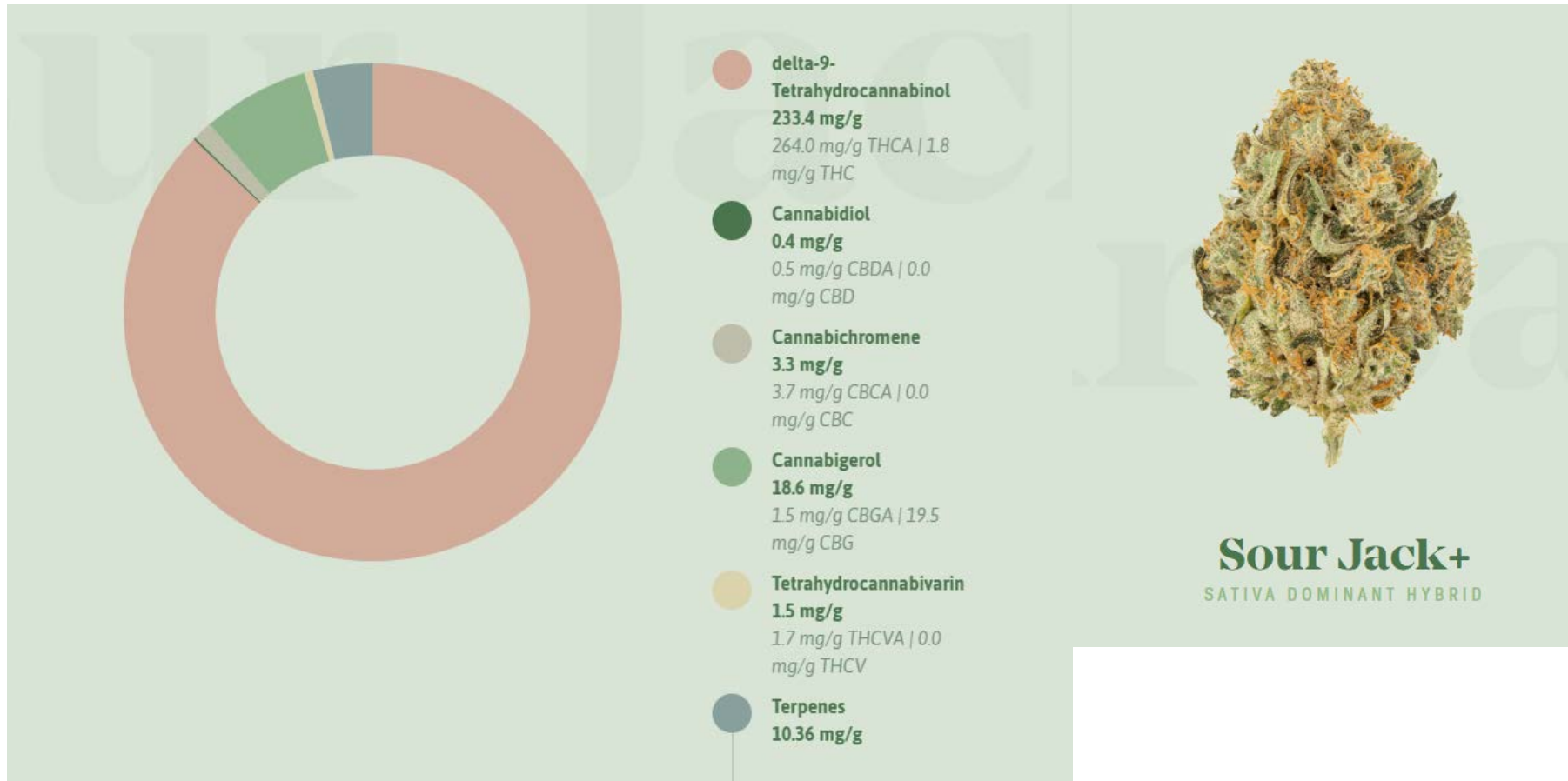


Cannabis Profile

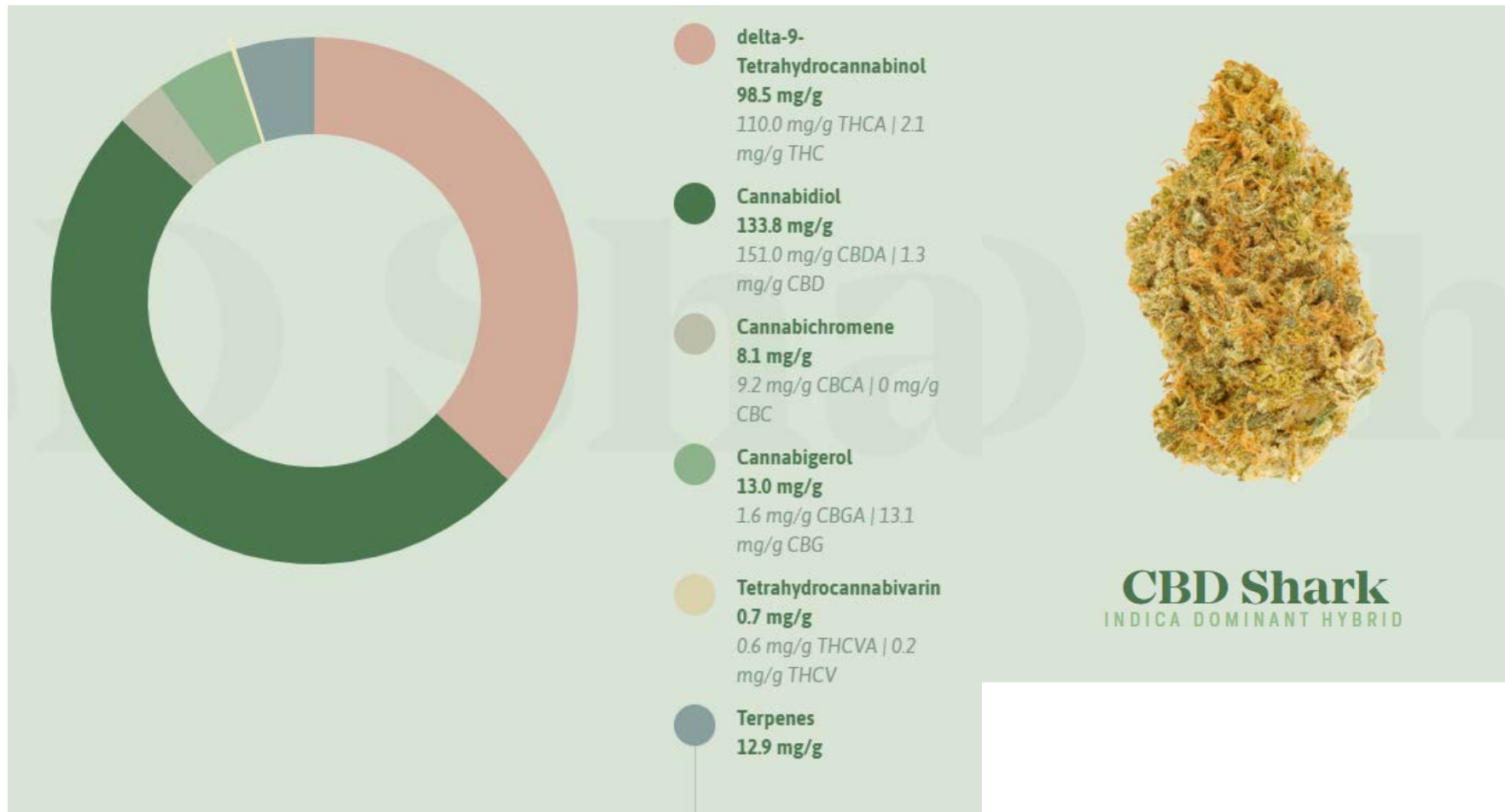
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CBCV (Cannabichromevarin)
THCP (Tetrahydrocannabiphorol)
...

Cannabinoid Profile Example 1



Cannabinoid Profile Example 2





Regulation of Cannabis

- **The Controlled Substances Act states:**

- "The term '**marihuana**' means all parts of the plant **Cannabis sativa** L., whether growing or not; the seeds thereof; **the resin extracted from any part of such plant; and every compound, manufacture, salt, derivative, mixture, or preparation of such plant**, its seeds or resin. Such term does not include the mature stalks of such plant, fiber produced from such stalks, oil or cake made from the seeds of such plant, any other compound, manufacture, salt, derivative, mixture, or preparation of such mature stalks (except the resin extracted therefrom), fiber, oil, or cake, or the sterilized seed of such plant which is incapable of germination."

- **21 U.S.C. § 802**

Regulation of Cannabis



U.S. DEPARTMENT OF JUSTICE



DRUG ENFORCEMENT ADMINISTRATION

DIVERSION CONTROL DIVISION

 Search

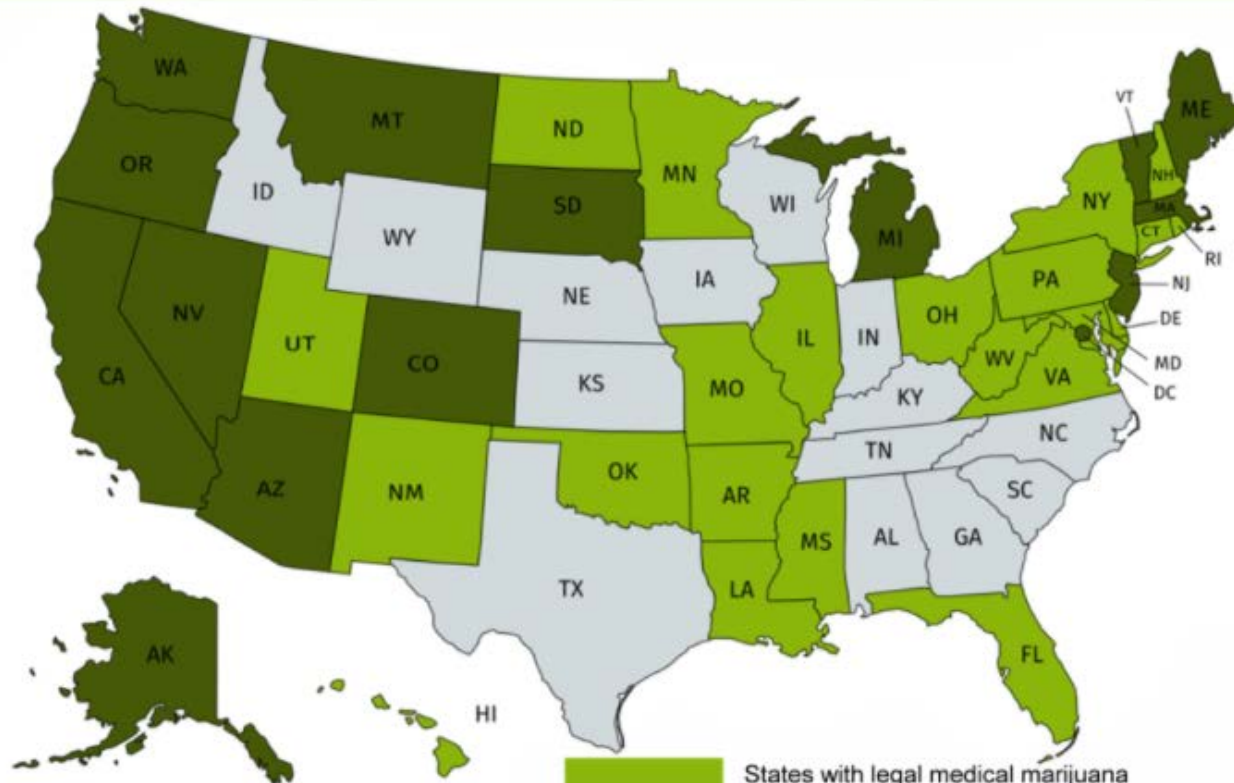
CONTROLLED SUBSTANCES - ALPHABETICAL ORDER -

SUBSTANCE	DEA NUMBER	CSA SCH	NARC	OTHER NAMES
Marihuana	7360	I	N	Cannabis, marijuana
Marihuana Extract	7350	I	N	
Tetrahydrocannabinols	7370	I	N	THC, Delta-8 THC, Delta-9 THC, dronabinol and others

https://www.deaiversion.usdoj.gov/schedules/orangebook/c_cs_alpha.pdf

State Laws on Cannabis Use/Possession

Legal Medical & Recreational Marijuana States



States with legal medical marijuana



States with legal medical & recreational marijuana

BRITANNICA
ProCon.ORG

RELIABLE.
NONPARTISAN.
EMPOWERING.



Legalization of Hemp

- **2018** Farm Bill removes hemp from Schedule I of CSA.
 - Legalizes hemp cultivation as an agricultural commodity.
 - Defines “**hemp**” as “the plant **Cannabis sativa L.** and any part of that plant, including the seeds thereof and all derivatives, extracts, **cannabinoids, isomers**, acids, salts, and salts of isomers, whether growing or not, ***with a delta-9 tetrahydrocannabinol concentration of not more than 0.3 percent on a dry weight basis.***”

2018 Federal Farm Bill

<https://www.govinfo.gov/content/pkg/PLAW-115publ334/pdf/PLAW-115publ334.pdf>

Regulation of Hemp vs Cannabis

Why did Congress set the dividing line at 0.3 percent?

- Dr. Ernest Small, a Canadian research botanist began studying cannabis in the 1970s.
- In 1976, Small published “A Practical and Natural Taxonomy for Cannabis,” which set a dividing line between hemp and marijuana at 0.3 percent THC for purposes of establishing a biological taxonomy.

TAXON 25(4): 405-435. AUGUST 1976

A PRACTICAL AND NATURAL TAXONOMY FOR CANNABIS*

Ernest Small** and Arthur Cronquist***


Summary

Variation in *Cannabis* is evaluated in the context of the confusing systematic history of this genus. Aside from some experimentally produced polyploids, all *Cannabis* is diploid ($n = 10$), and there appear to be no barriers to successful hybridization within the genus. The present pattern of variation is due in large part to the influence of man. Two widespread classes of plant are discernible: a group of generally northern plants of relatively limited intoxicant potential, influenced particularly by selection for fibre and oil agronomic qualities, and a group of generally southern plants of considerable intoxicant potential, influenced particularly by selection for inebriant qualities. These two groups are treated respectively as subsp. *sativa* and *indica*, of *C. sativa*, the only species of the genus *Cannabis*. Within each subspecies two parallel phases are recognizable. The “wild” (weedy, naturalized or indigenous) phase is more or less distinguishable from the domesticated (cultivated or spontaneous) phase by means of an adaptive syndrome of fruit characteristics. The resulting four discernible groups are recognized as varieties.

<https://harrisbricken.com/cannalawblog/the-hemp-standard-is-0-3-thc-that-should-be-changed/>

Hemp vs. Marijuana?

Hemp	Marijuana
Psychoactive Content: Trace amounts 0.2-0.3%	Psychoactive Content: Yes, in varying quantities.
Estimated levels of THC: Low THC (<0.3%)	Estimated levels of THC: High THC (4%-35%)
Uses: Building materials, skin care, clothing, construction, amongst many other areas of industry.	Uses: Marijuana is generally grown for flower production, which are commonly used for either recreational or medical purposes.
Legality: The plant is generally considered legal if the THC content is below 0.3% in the US and below 0.2% for European standards.	Legality: Each country (or state in the US) will have varying laws, but is considered illegal across the majority of the globe.



- Morphological characteristics of the plant (macroscopic, microscopic, smell, etc.) are exactly the same.
- A person cannot tell the difference by looking at or smelling the plant.
- The only way to differentiate is through laboratory testing to determine THC concentration.
- How does the user know what they are consuming – the packaging!

<https://www.endoca.com/>

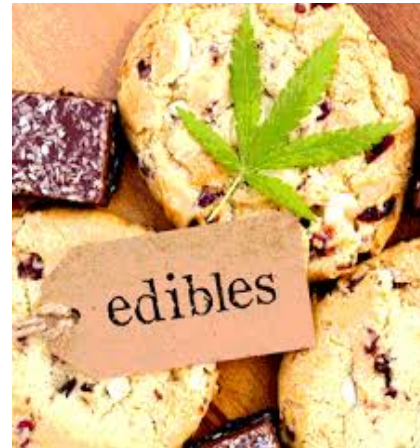
Cannabis and Hemp Derived Products

- Hemp
- Medical Cannabis
- Recreational Cannabis
- ... and products made from cannabis and hemp.





Cannabis Derived Products



The Future of Edibles?

Resources Blog Journalists

Log In Sign Up Data Privacy Send a



News

Products

Contact

Se

News in Focus

Business & Money

Science & Tech

Lifestyle & Health

Policy & Public Interest

People & Culture

Cannabis Edibles Market Expected to Quadruple to \$4.1 Billion

FN Media Group Presents Potstocknews.com Market Commentary

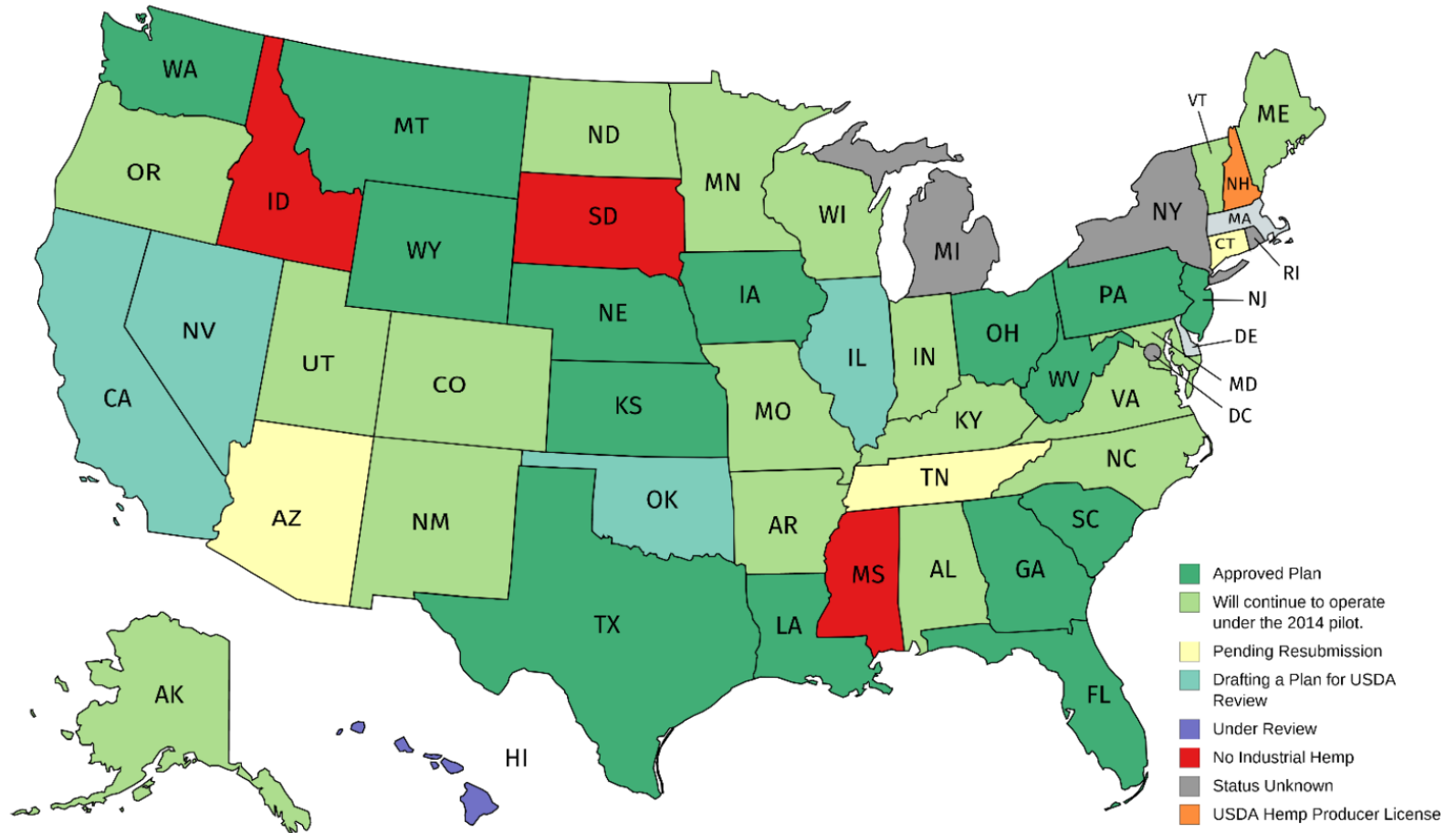
NEWS PROVIDED BY
Potstocknews.com →
Apr 22, 2019, 08:45 ET

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NEW YORK, April 22, 2019 /PRNewswire/ -- From candy and chocolate to infused beverages, the cannabis edibles market will hit \$4.1 billion by 2022 according to a [research report](#) from ArcView. Now many in the industry are stocking up on new edible offerings, including **Cannabis One Holdings Inc.** (CSE:CBIS) (OTC:CAAOF), **Canopy Growth Corp** (NYSE:CGC) (TSX:WEED), **Koios Beverage Corp.** (CSE:KBEV)(OTC:KBEVF), **Tilray, Inc.** (NASDAQ:TLRY) and **HEXO Corp.** (NYSE:HEX) (TSX:HEXO).

Status of States Hemp Plans





What about Hemp Derived Products?

- “The term “hemp” means the plant *Cannabis sativa* L. and any part of that plant, including the seeds thereof and all derivatives, **extracts**, cannabinoids, isomers, acids, salts, and salts of isomers, **whether growing or not**, with a delta-9 tetrahydrocannabinol concentration (THC) of not more than 0.3 percent on a dry weight basis.”

7 U.S. Code § 1639o. Definitions

Hemp Derived Products





What about Cannabidiol (CBD)?

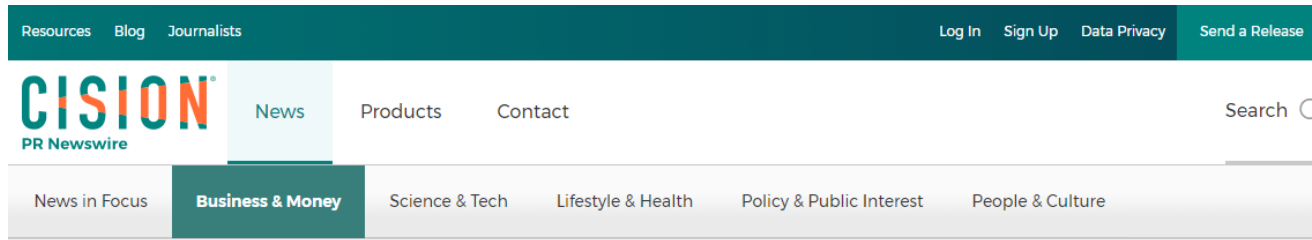
- **CBD** is a non-psychoactive component of the THC plant.
- **CBD** is not mentioned in the 2018 Farm Bill.
- **Hemp-derived CBD** is legal in all 50 states can be easily obtained through online websites, at gas stations, and at mall kiosks. Hemp-derived CBD contains virtually no THC
- **Cannabis-derived CBD** can include flowering portions of the plant, and a license is required to cultivate it. Cannabis-derived CBD, contains higher levels of THC.
- Efficacy for **CBD** is claimed for anxiety, depression, post-traumatic stress disorder, seizures, sleep...
- ... also to counteract the growth of [and/or] spread of cancer, treating Parkinson's disease, treatment of Alzheimer's disease, schizophrenia and others.



CBD Products from Hemp



The Future of CBD?



CBD Infused Beverages Market Size Expected to Reach \$2.8 Billion by 2025

Financialnewsmedia.com News Commentary

NEWS PROVIDED BY
[FinancialNewsMedia.com](https://financialnewsmedia.com) →
May 27, 2020, 08:45 ET

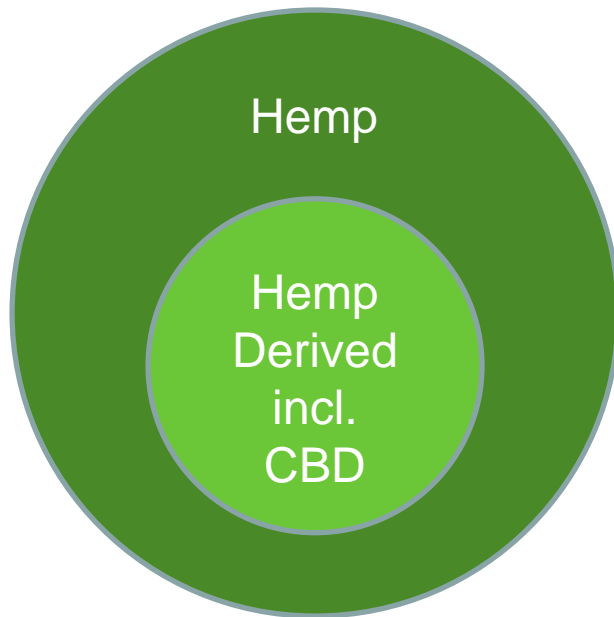
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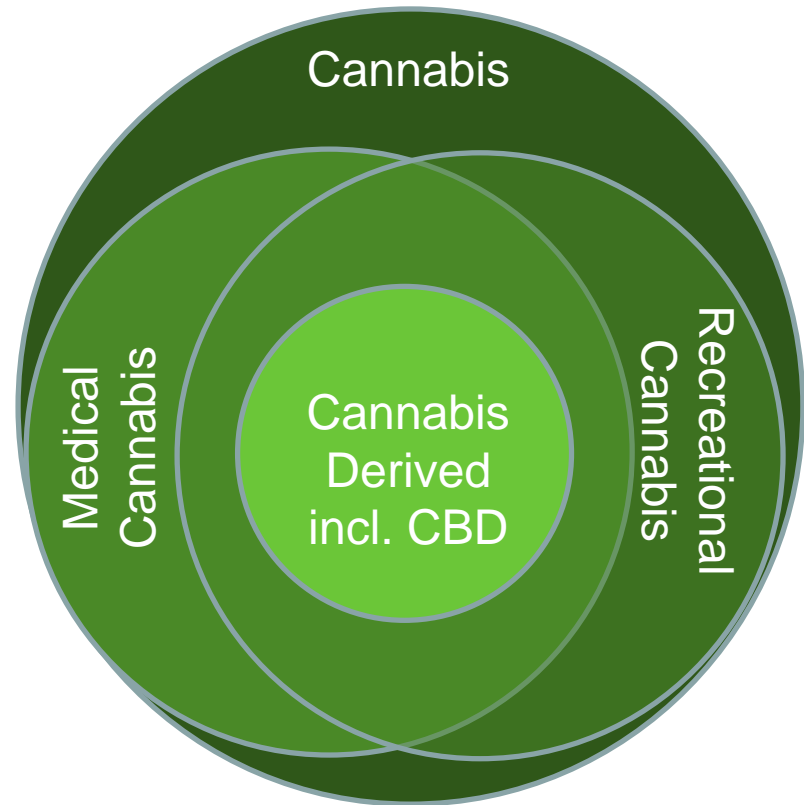
PALM BEACH, Florida, May 27, 2020 /PRNewswire/ -- In the past, THC and CBD were (and still are) battling it out for what segment is achieving the higher percentage and the total amount of revenues generated... but when it comes to the beverages market... there seems to be green fields aplenty for them both! A [recent report](#) by Grand View Research said that the global cannabis beverages market size is expected to reach USD 2.8 Billion by 2025 at a CAGR of 17.8%. The report looked at alcoholic and non-alcoholic beverages using either TCH or CBD. It said: "By component, the market is segmented into Cannabidiol (CBD) and Tetrahydrocannabinol (THC). The demand of THC infused cannabis beverages is majorly driven by rising product demand from adult consumers for recreational purposes. Rising demand for the therapeutic effects of the component along with the euphoria it provides is expected to bode well for the growth of the segment in the forthcoming years." Active companies in the industry making moves to ready that include: **Cannabis Global, Inc.** (OTCPK: MCTC), **Aphria Inc.** (NYSE: [APHA](#)) (TSX:APHA), **CV Sciences, Inc.** (OTCQB: [CVSI](#)), **Hexo Corp** (NYSE: [HEXO](#)) (TSX:HEXO), **Molson Coors Beverage Co.** (NYSE: [TAP](#)).

Cannabis and Hemp

THC $\leq 0.3\%$

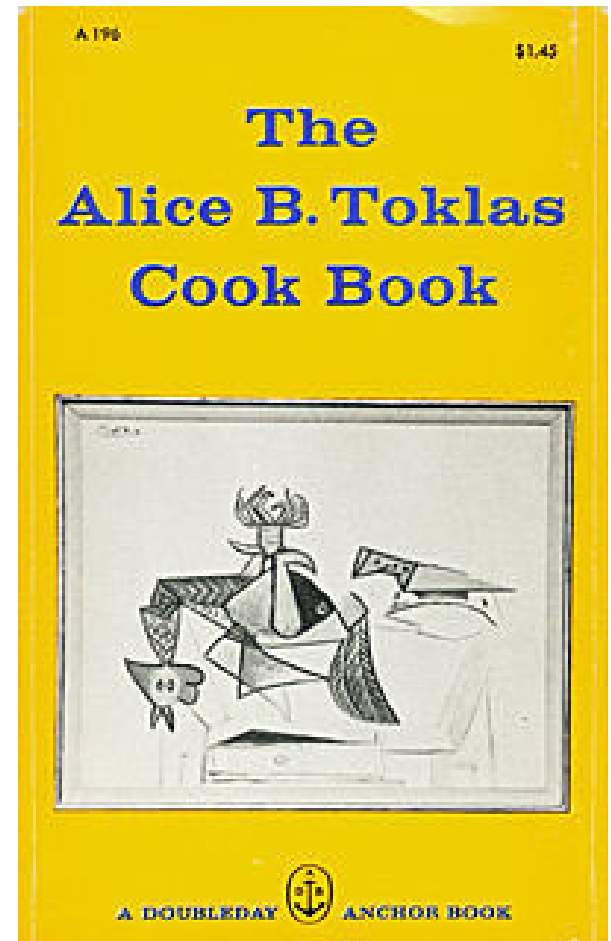


THC $> 0.3\%$



The Origins of Edibles?

- Hashish Fudge
 - Made from spices, nuts, fruit, ... and cannabis
 - "easy to whip up on a rainy day."
 - "Two pieces are quite enough"
 - "One should be prepared for hysterical fits of laughter and wild floods of thoughts on many simultaneous planes."





Delta-9-THC Content of Hemp/Cannabis Derived Products

Exhibit	Mean (+SD)	Median	Range
Waxes	62% \pm 16%	67%	25% - 81%
Butter	-	81%	-
Dabs	64% \pm 12%	69%	50% - 73%
Hard Candies	negative	-	-
Mints	-	0.63%	-
Gummies, Nerd Ropes, Cereal bars, Brownies, Kool aid	~0.13%	-	-



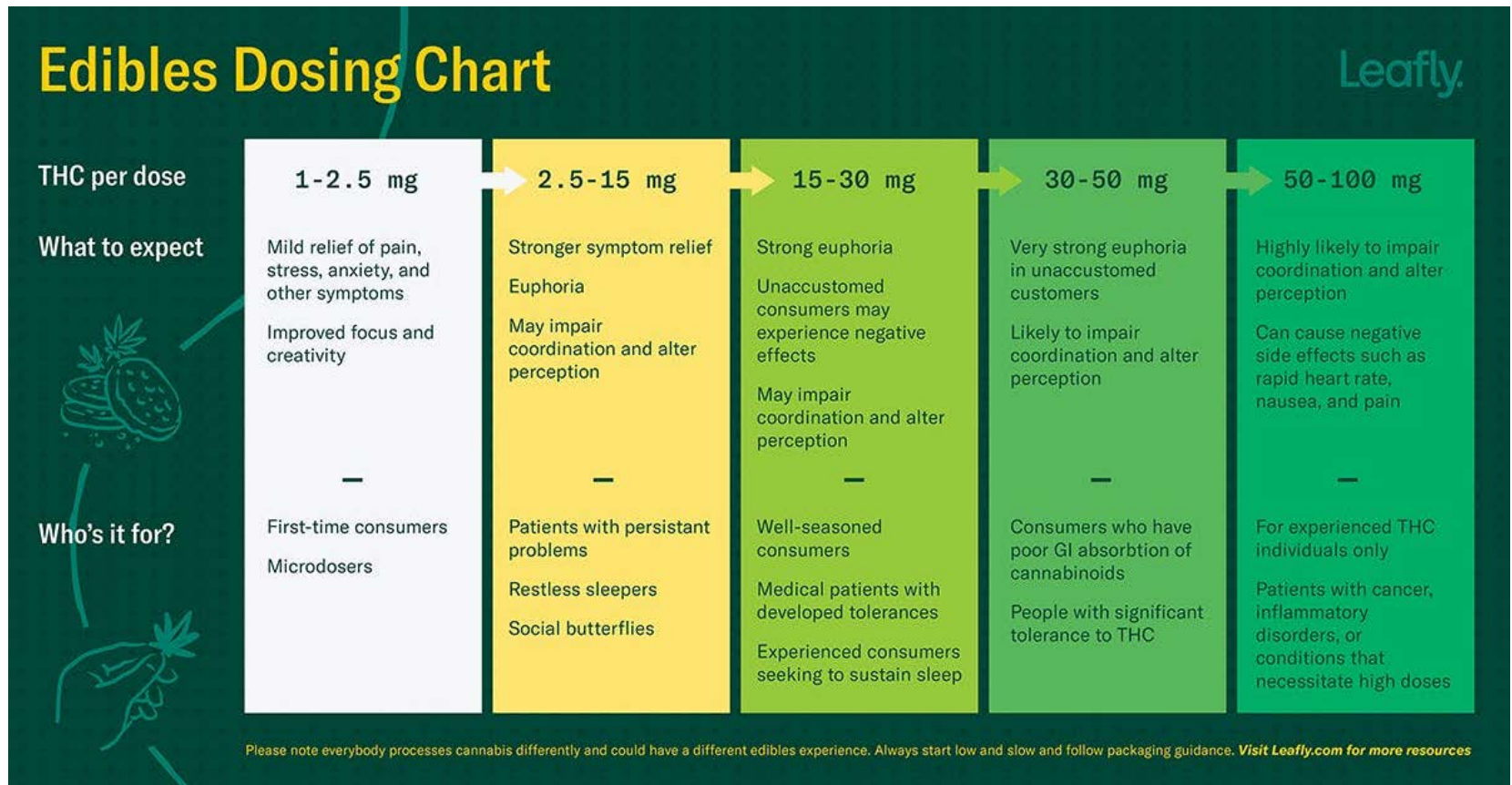
THC Doses from CBD Edibles



$$5\text{g} * 3 \text{ gummies} = 15\text{g}$$

$$15\text{g} * 0.13\% \text{ THC} = 19.5\text{mg THC}$$

THC Doses from CBD Edibles





Distinguishing CBD/Cannabis Ingestion

- CBD products may contain delta-9-THC
- Ingestion may result in THC metabolites in the urine above the threshold for a positive test.
- Looking at the ratio of CBD to THC metabolites may help distinguish, THC contamination in CBD vs cannabis use.

CLINICAL TOXICOLOGY
<https://doi.org/10.1080/15563650.2020.1827148>



BASIC RESEARCH



Using measured cannabidiol and tetrahydrocannabinol metabolites in urine to differentiate marijuana use from consumption of commercial cannabidiol products

Melissa M. Goggin and Gregory C. Janis

MedTox Laboratories, Laboratory Corporation of America Holdings, St. Paul, MN, USA

Conclusions

- The Cannabis/hemp products markets are confusingly regulated, state by state, and changing weekly.
- Manufacturer testing/labelling requirements are inconsistent, and testing labs are of variable quality.
- Hemp derived products and CBD preparations can contain up to 0.3% delta-9-THC.
- Products with less than 0.3% delta-9-THC can still cause intoxication and a positive urine test.
- Caveat Emptor...

barry.logan@nmslabs.com

www.nmslabs.com

THC & CBD: SETTING THE RECORD STRAIGHT: DISPELLING COMMON MYTHS AND MISCONCEPTIONS

(Chemistry, Toxicity, Poisonings)



Michelle R. Peace, Ph.D.
Associate Professor
Department of Forensic Science
Virginia Commonwealth University

LFTR
Laboratory for Forensic
Toxicology Research

1

NIJ Statement and Financial Disclosure

- **Through the Looking Glass: Part 1 & 2 Abuse of the Evolving Electronic Cigarette and the Impact of Vaping Ethanol in the Evaluation of Impairment**
- **Characterization and Abuse of Electronic Cigarettes: The Efficacy of Personal Vaporizers as an Illicit Drug Delivery System**
- **Chasing the E-cigarette Dragon: Characterizing the Evolution and Impact of Design and Content**

are supported by **Award Nos. 2014-R2-CX-K010 and 2016-DN-BX-0150 and 2018-75-CX-0036, 2019-MU-MU-0007** awarded by the **National Institute of Justice**, Office of Justice Programs, U.S. Department of Justice. The opinions, findings, and conclusions or recommendations expressed in this publication/program/exhibition are those of the author(s) and do not necessarily reflect those of the Department of Justice.

- No funding was obtained from any manufacturer of any product used in this study.

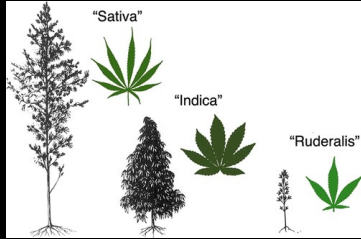
2

Cannabis sativa

C. sativa

C. indica

C. ruderalis



•550+ different chemical compounds

- Cannabinoids
- Terpenes
- Hydrocarbons
- Sugars
- Proteins
- Acids
- Alcohols

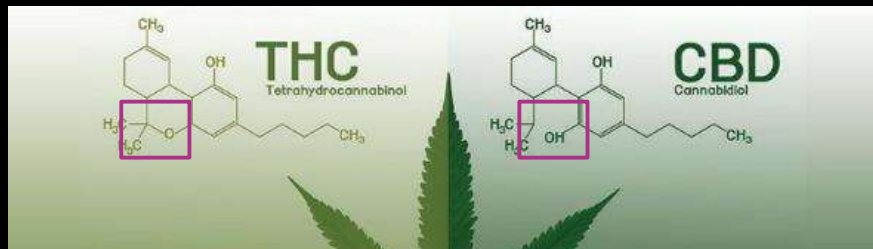
•Natural Chemotypes

- THC >> CBD
- THC ≈ CBD
- THC << CBD

•Genetic Manipulation



3



Physiological	Behavioral and Psychological
Tachycardia	Euphoria
Dry mouth/throat	Sedation
Increased appetite	Relaxation
Vasodilation	Disinhibition
Bronchodilation	Impaired short-term memory
Decreased respiration	Distortion of body/time
	Perceived increase in auditory/visual acuity
	Synesthesia

Physiological	Behavioral and Psychological
Dry mouth/throat	Anxiety reduction
Increased appetite	Deep relaxation
Sleep aid	Non-hedonic
Bronchodilation?	

4

CANNABINOIDS REQUESTED FOR QA PURPOSES

Delta 9-THC

CBD

THCA-A

CBD-A

Delta 8-THC

CBDV

CBC

CBG

CBG-A

CBN

THCV

5

THC & CBD

Pharmacology

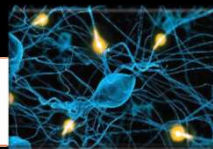
Pain relief



Seizures



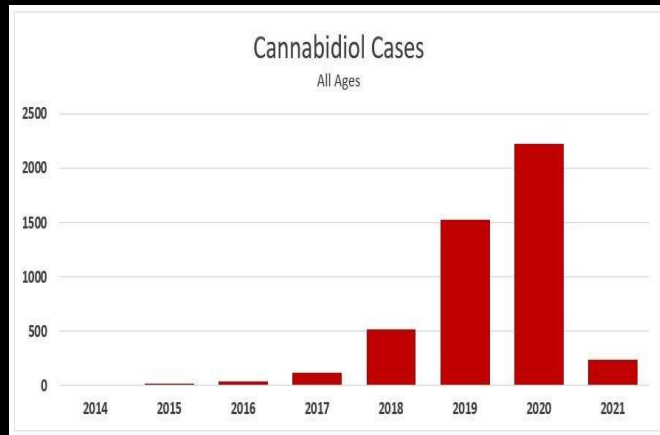
Neurodegenerative Diseases



6

CBD Poison Control Centers

As of January 30, 2021

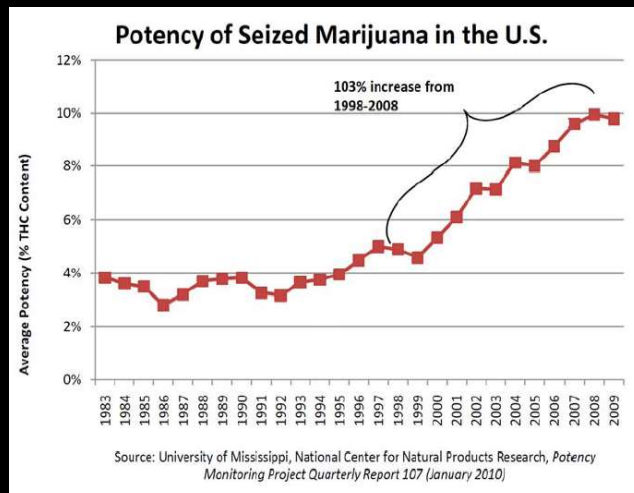


American Association of Poison Control Centers
Accessed 01.30.21

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Product Consistency

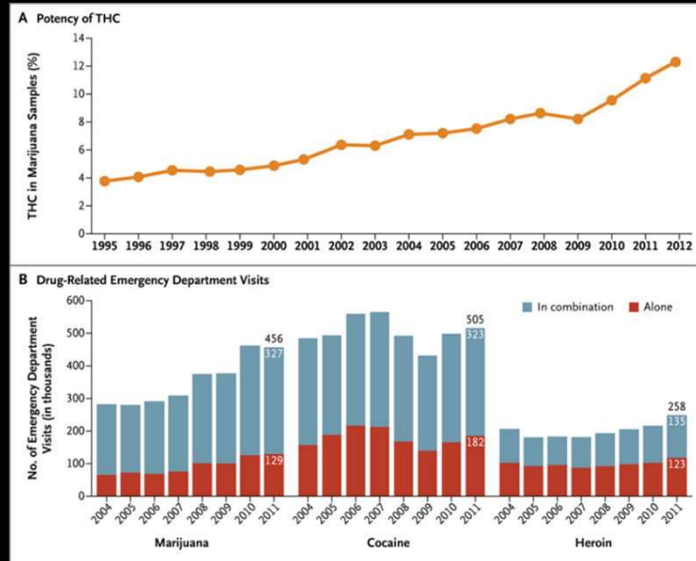
- Cannabis Potency



8

Cannabis Potency vs ED Visits

Hyperemesis
Psychosis
Drug-Drug Interactions



N Engl J Med. 2014 Jun 5;370(23):2219-27.

9

Cannabis Potency

Depends on the Product Type

Leaves/Stems/Seeds

Hashish

Hash

Tincture

Waxes &
Dabs

Edibles

Creams
&
Lotions

E-liquids

10

CANNABINOID HYPEREMESIS

- Syndrome associated with the chronic use of cannabis, characterized by recurrent episodes of nausea, vomiting, abdominal pain, and compulsive hot bathing.
- Weekly use of cannabis
- Morning predominance of symptoms
- Normal bowel habits



DeVuono, Parker. Cannabis and Cannabinoid Research (2020) 5:2

11

CANNABIS PSYCHOSIS



Susceptibility

People diagnosed with psychosis & schizop. more likely to report cannabis use

Cannabis use doubles risk for psychosis in vulnerable people

Dose/Frequency

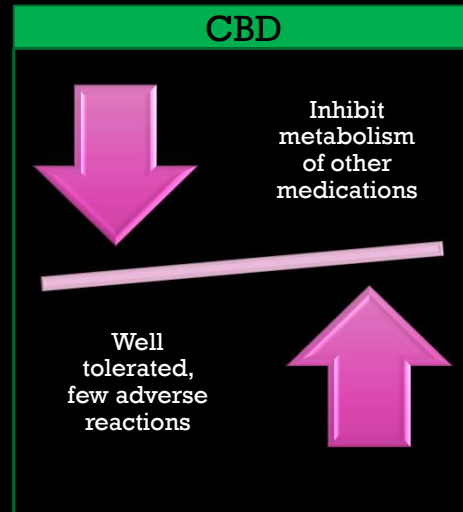
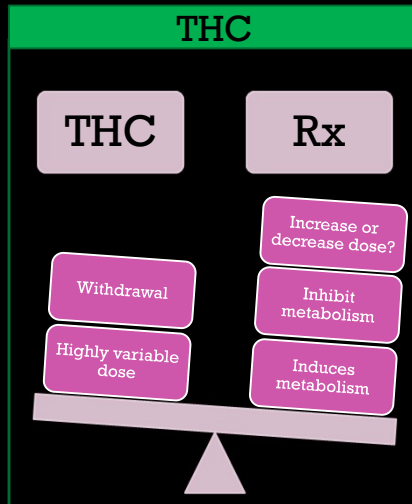
Acute, temporary psychosis

Anxiety, dysphoria, synesthesia are not the same as long-term psychosis

Ksir et.al. Current Psychiatry Reports (2016) 18
 Ortiz-Medina et.al. Int J Soc Psychiatry (2018) 64(7).
 D'Souza et.al. Curr Pharm Des (2016) 22(42)
 Murray et.al. Neuropharmacology (2017) 124

12

THC/CBD DRUG-DRUG INTERACTIONS



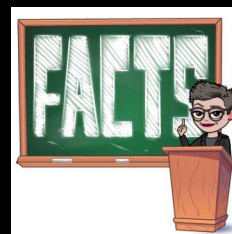
Chesney et al. Neuropsychopharmacology (2020) 45.
Kocis, Vrana. Medical Cannabis and Cannabinoids (2020) online

13

DRUG TESTING & CBD



“If you use CBD products, you could be positive for THC in a drug test.”



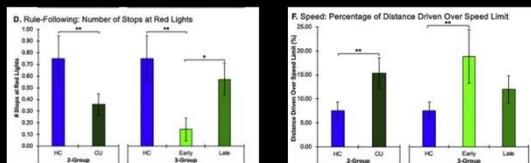
Crippa, et al. Cannabis and Cannabinoid Research (2020) 5:1
Golombek et al. Toxics (2020) 8:41

14

CANNABIS AND DRIVING

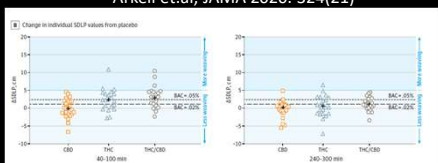
Recreational cannabis use impairs driving performance

Dahlgren et.al. Drug Alcohol Dependence 2020 (208)

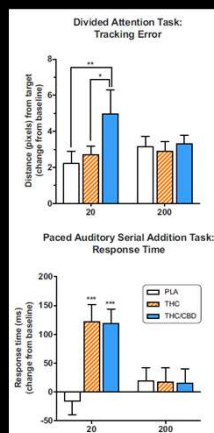


CBD and d9-THC produce short term driving impairment.

Arkell et.al, JAMA 2020. 324(21)



CBD does not prevent THC-induced impairment of driving and cognition



Arkell et.al, Psychopharmacology (2019)236

15

KCN's view - May 26, 2018: 0:00:00

Fake CBD Poisoned At Least 52 People In Utah Last Winter, Officials Say

Janet Burns Senior Contributor @ Character Tech
A mix of cannabinoids, taking drugs, and more

Photo: iStockphoto

The New York Times

Ads Pitching CBD as a Cure-All Are Everywhere. Oversight Hasn't Kept Up.

APHC ARMY PUBLIC HEALTH CENTER

Home Organization Topics Products & Services Research Materials Training Help

APHC Home / Topics / Health / Marijuana / Health Effects of Vape Oils Containing Unknown Substances

Health Effects of Vape Oils Containing Unknown Substances

Last Updated April 17, 2019

APHC Home / Topics / Health / Marijuana / Health Effects of Vape Oils Containing Unknown Substances

PUBLIC HEALTH ALERT

PUBLIC HEALTH ALERT: Users of e-cigarettes and/or vaporizer pens must ensure that the products they purchase do not contain Cannabidiol (CBD) oil, CBD, tetrahydrocannabinol (THC) or synthetic cannabinoids.

[CLICK HERE TO VIEW THE ALARMS ON ARO \(CAC REQUIRED\)](#) #

Other Articles

Annual Tuberculosis Report

Information about the currently reported incidence of tuberculosis in the United States.

Related Dates

Related Date for 2018 (2018)

TFL Solution for Information and Education on Tuberculosis

Look for C&EN's next issue on Jan. 7, 2019

c&en

CHEMISTRY & ENGINEERING NEWS

YEAR IN CHEMISTRY

C&EN spotlights the most memorable molecules and biggest scientific trends of 2018.

P.28

ACS

Research of the Year 2018

SCIENTISTS ANALYZED THE CHEMISTRY OF POPULAR E-CIGARETTES

Studies helped explain e-liquid's appeal and uncovered unexpected contaminants.

In New Haven

CBD oil and other cannabinoids in vaping pens might be driving users to emergency rooms, North Carolina health authorities say, Sept. 1, 2019 - AP

CBD oil in your e-cig or vape pen might send you to the ER, NC says

By David S. Reardon
Researcher at the University of North Carolina

North Carolina health authorities say, Sept. 1, 2019 - AP

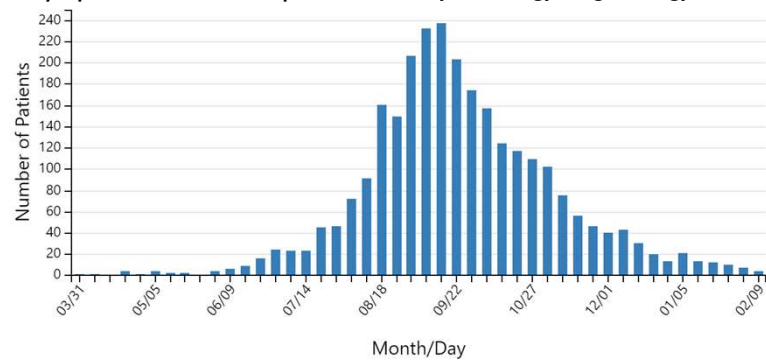
16



As of Feb 18, 2020:

- 2807 hospitalizations
- 68 deaths
- Age range: 15-75yo
- Median age of hospitalized Px:
 - 24
- Median age deceased Px:
 - 49.5
- 82% used THC products
 - 33% used THC exclusively
- 57% used nicotine products
 - 14% used Nic exclusively

Symptom onset and hospital admission, March 15, 2019-Feb 15, 2020



Numbers do not sum to 2,807 due to missing admission dates.



https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease

17

ACUTE LUNG INJURY

Epithelial and endothelial cell damage



Destruction of alveolar-capillary membrane



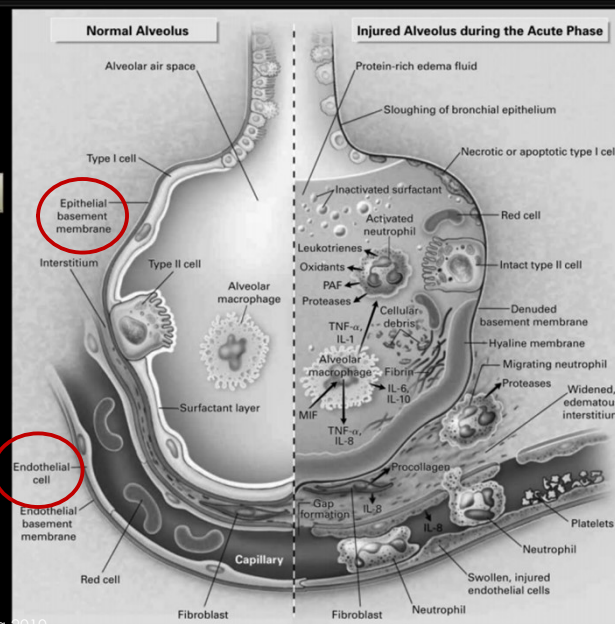
Fluid fills aveoli



Neutrophils migrate into lungs



Release of pro-inflammatory and cytotoxic factors



Johnson & Matthay. J Aerosol Med & Pulm Drug Delivery. 23(4) 9 Aug 2010

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E-LIQUID COMPOSITION



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Current LFTR Database E-LIQUID COMPOSITION

- 267 different chemicals
 - Evolved with device capabilities and pharmacologically active ingredients

- Vitamin E/Vitamin E Acetate
 - believed to be used as a preservative/stabilizer
- Olivetol
 - precursor in THC synthesis
 - Lichen origin added to counteract an "uncomfortable high"

- Ethyl Maltol - irritant
- Vanillin - irritant
- α -Monoacetin - irritant
- Raspberry ketone - irritant
- Vanillin PG acetal – health hazard
- Linalool - irritant
- Caryophyllene - irritant, health hazard
- γ -Decalactone - irritant
- γ -Undecalactone - irritant, health hazard
- Maltol - irritant
- Bisabolol - irritant, environmental hazard



APHL Notices

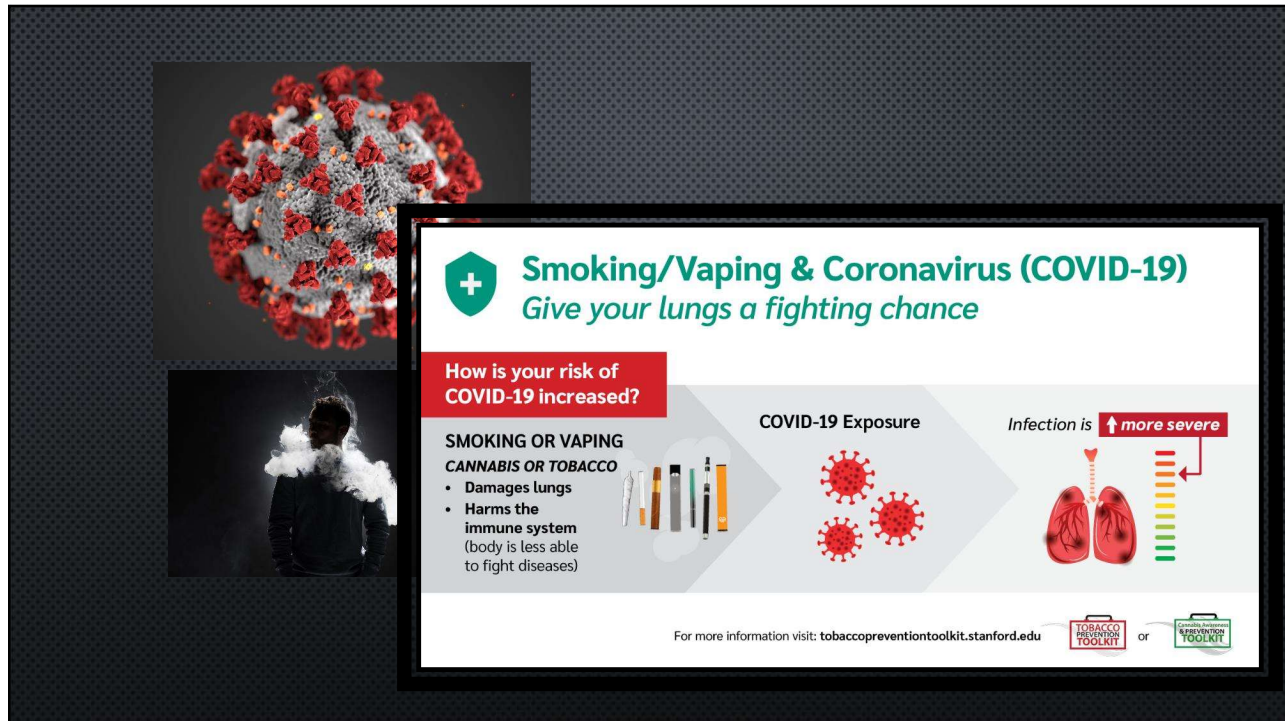
Pine rosin – "used to treat rheumatism"
 Ethenone – must be manufactured,
 extremely toxic

MENTHOL – unlabeled ingredient

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20



Smoking/Vaping & Coronavirus (COVID-19)
Give your lungs a fighting chance

How is your risk of COVID-19 increased?

SMOKING OR VAPING CANNABIS OR TOBACCO

- Damages lungs
- Harms the immune system (body is less able to fight diseases)

COVID-19 Exposure

Infection is **↑ more severe**

For more information visit: tobaccopreventiontoolkit.stanford.edu

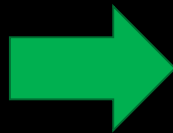
TOBACCO PREVENTION TOOLKIT or **Cannabis Prevention Toolkit**

21

SUMMARY

Robust, objective scientific data is lacking

“Research as marketing” degrades public trust



22

Laboratory for Forensic Toxicology Research:

Students:

Haley Mulder	Kaitlyn Brooks
Jesse Patterson	Ivy Blue
Tyson Baird	Rose Krakowiak
Lori McLean	Laura McNew
Karen Butler	Jimmy Stewart
Alaina Friedrich	Alex Dupont
Joseph Stone	Katitlyn Forsythe
Shelle Butler	Jasmyne Royals
Mika Smith	Jazmine Povlick
Jonathan Tomko	Grace Connolly
Kimberly Karin	Erica Sales

#LFTR



VCU Collaborators:

- Justin Poklis, B.S., D-ABFT-FT, Pharm/Tox
- Joseph Turner, Ph.D., Chemistry
- Matt Halquist, Ph.D., Pharmaceutics
- Michael Hindle, Ph.D., Pharmaceutics
- Carl Wolf, Ph.D., Clinical Toxicology
- Alaina Friedrich Holt, Forensic Science

23

Thank you

Michelle Peace, Ph.D.

Laboratory for Forensic Toxicology Research
Department of Forensic Science
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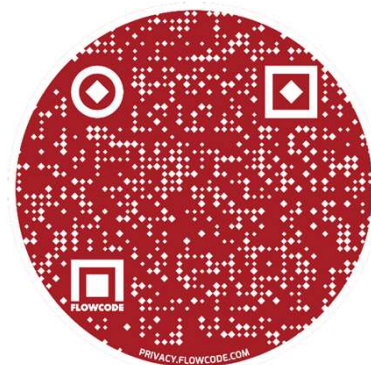
LinkedIn: Michelle Peace

Co-Investigator: Justin L. Poklis

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Forensic Toxicology
Research



[Link to Research and Lab Team Blog](#)

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24

Regulations, oversight, and adulterations of CBD products.



DARRIN T. GRONDEL

FEBRUARY 10, 2021

What do we know about Cannabis?

480 Chemical Compounds

66 – 113 cannabinoid
compounds

Cannabinol CBN (1899)

Cannabidiol CBD (1963)

Delta 9 – THC (1964)

Cannabigerol CBG

Cannabichromenes-CBC

Cannabinodial CBDL

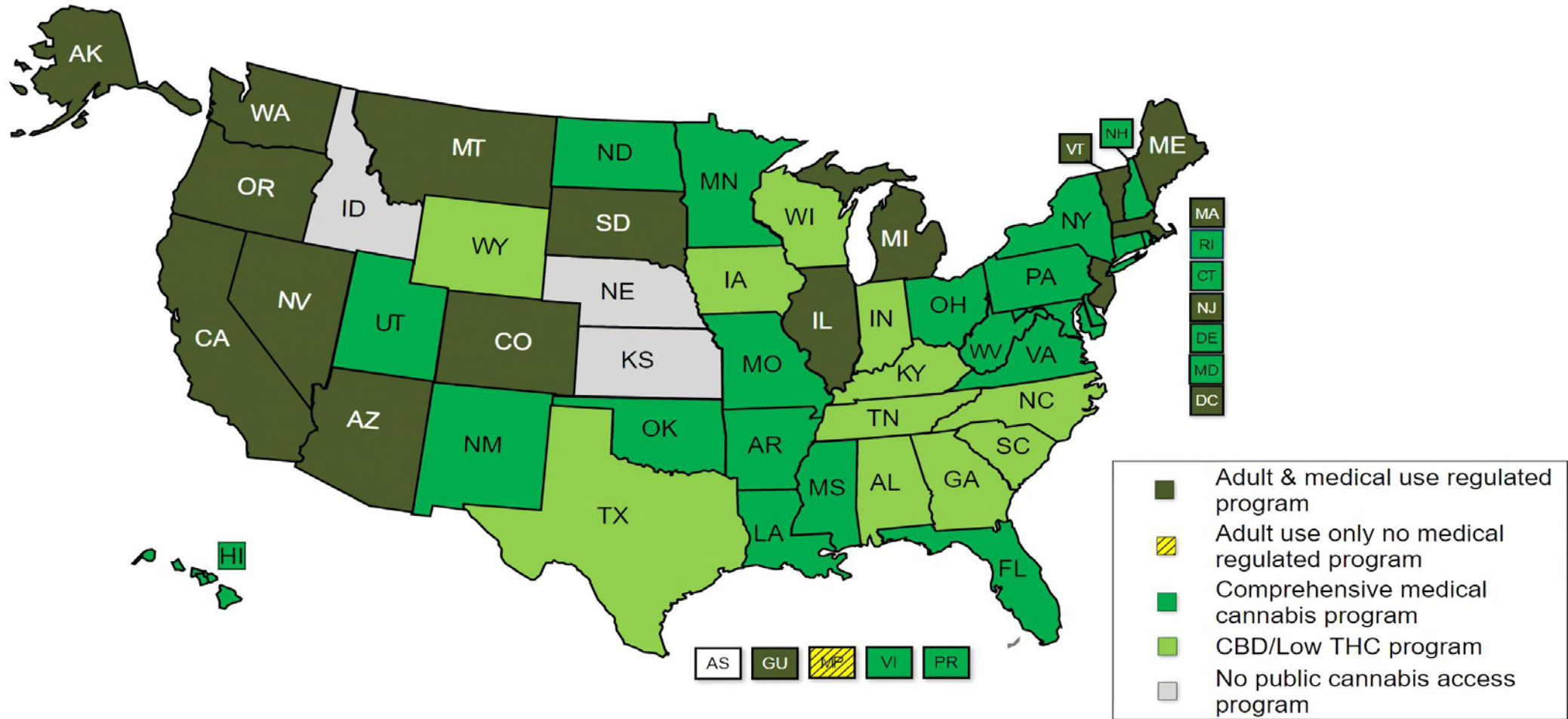
Cannabicyclol CBL

Cannabielsoin CBE

Cannabitriol CBT

Cannabidivarin CBDV

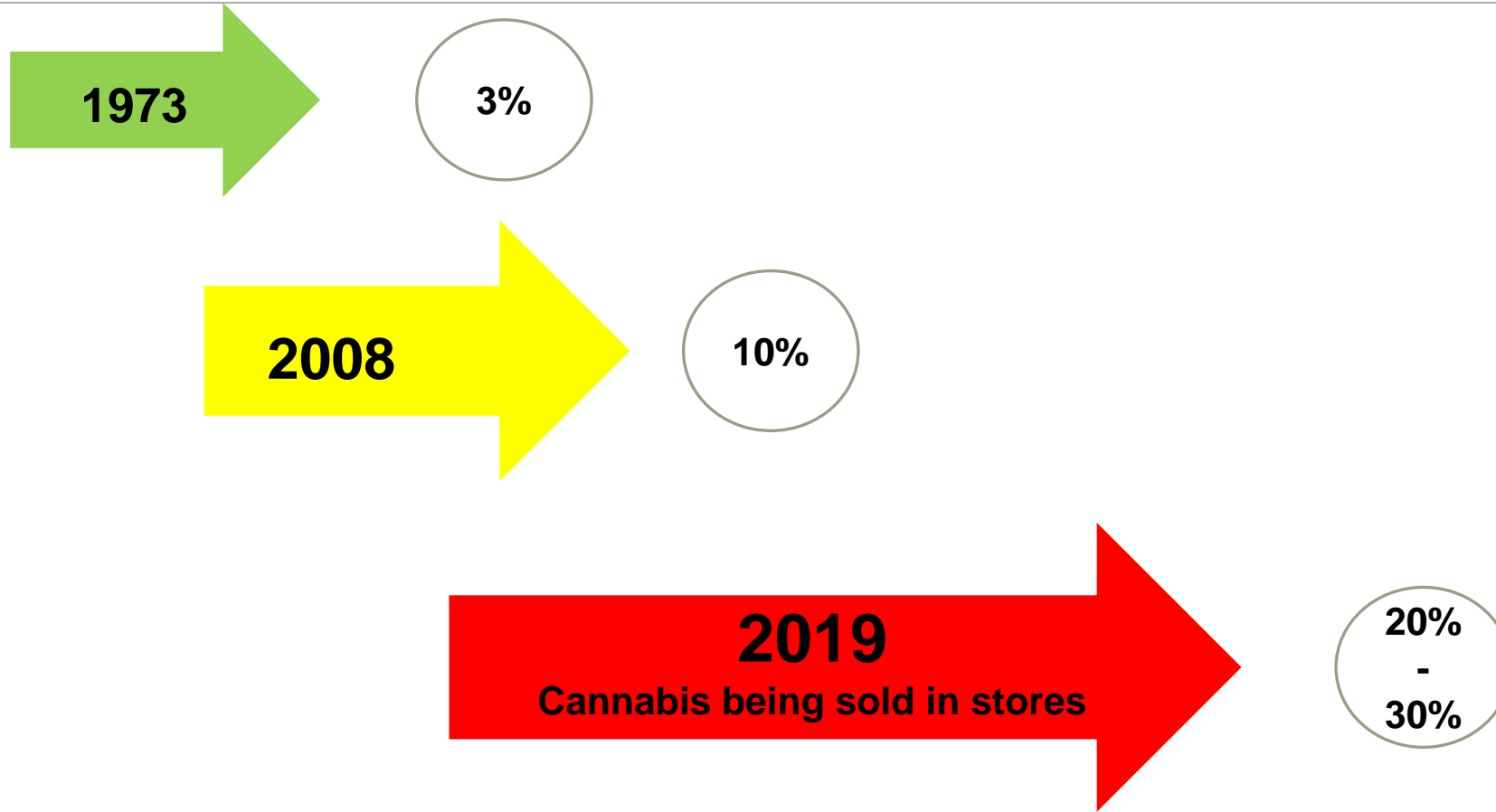
CBD Legal States in 2021



Regulation of CBD

- Is CBD legal in the U.S? Agricultural Improvement Act – the 2018 Farm Bill allows for
- Federal - Food and Drug Administration has **not** approved CBD for any disease or condition
 - **Exception** - Epidiolex – Purified form of CBD – Seizures - Lennox-Gastaut syndrome or Dravet syndrome, and tuberous sclerosis complex.
 - Prescribed by a medical provider and medication guide due the impacts
- The Federal Food, Drug and Cosmetic Act (FD&C) addresses unapproved products with product claims it treats, diagnosis, mitigates, treats or cures various diseases.
- Is it legal in your State? Check your state laws as they differ (<https://www.ncsl.org/research/health/state-medical-marijuana-laws.aspx>)
 - Some states legalized for CBD products that are **approved by the Food and Drug Administration** (FDA), so is this a safeguard for the state?
 - Some include both FDA approval and <0.3% THC
 - Some <0.3% THC, no edibles, exception gelatin cubes (who is testing this for the quantity?)
 - Some require the CBD comes from Hemp extracts.
 - Medical use in some states vary in THC concentration level (VA, GA <5% THC concentration in CBD)

THC Concentrations over the Years



THC Potency Used In Most Government Studies addressing crash risk

3 – 6 %
THC



Regulation



- Manufacturing process of CBD products has not been assessed by the FDA
- “A regulatory standard for labeling accuracy of CBD does not exist” (Geoffrey et al, 2021)
- No third-party regulatory process nationally or at state level to verify product ingredients, contaminants, or quality.
- FDA sent out five warning letters in December of 2020 to companies who are illegally selling unapproved CBD products in violation of the FD&C.
- Impaired Driving – the FDA found that CBD can cause sleepiness, sedation, and lethargy, based on their research with Epidiolex. Remember, if tested and taking CBD products, the THC could be detected.

Regulation – Labeling – Adulteration

- Horth, R. Z. et al, Acute poisonings from a Synthetic Cannabinoid - Utah 2017- 2018
- Clear case of why we need regulation, accuracy in labeling and concerns of adulteration
- 52 people identified
- Branded as “YOLO CBD Oil”
- “Nine product samples (including one unopened product purchased by investigators from a store and brand reported by a patient) were found to contain a synthetic cannabinoid, 4-cyano CUMYL-BUTINACA (4-CCB), but no CBD.”
- Symptoms – altered mental state, nausea or vomiting, and seizures or shaking, anxiety, unconsciousness.
- 73% vaped, 17% sublingual
- 67% Recreational, 28.8% Medical,

Adulterations

CBD products are not regulated and is subject to concerns about product labeling, contaminants, or adulterations...

(Gurley et al., 2020) research on labeling consistency for cannabidiol (CBD) products examined 25 different commercial samples obtained in the state of Mississippi.

- Only three were within 20% of claimed labeling
- 15 were well below stated claims
- Two exceeded claims by more than 50%
- Three exceeded the legal limit of 0.3% THC content
- Four products marketed for vaping were contaminated with synthetic cannabinoids (potential for acute and chronic health effects)

Adulterations

(Orsburn, 2020) investigation of 21 commercial CBD products found similar results as the Gurly study and additionally identified several other drug adulterants (likely purposefully added) contaminants (residual or unintended inclusions, such as a surfactant used in material preparation).

- The most common contaminant was erucamide (N = 4), a surfactant used in manufacturing that is typically identified and removed in pharmaceutical products. Other contaminants included several polyethylene glycol compounds, 1-Naphthol, and more.
- Adulterants identified
 - Caffeine (1) and theobromine (1)
 - Valpromide (1), a pharmaceutical anticonvulsant
 - Melatonin (2)
 - Yohimbine (1) a supplement used in a variety of applications
 - Suspected fluorofentanyl (1) a designer opioid

TABLE 1 | List of *Cannabis* contaminants and sources, target/mechanism, and its respective risks to human health. Abbreviation: GABA: γ -amino butyric acid.

Contaminant		Source	Target/Mechanism	Health Risk	References
Microbes	<i>Aspergillus</i> Species	Soil/Environment	Pulmonary Infection	Aspergillosis (Keratitis, Onychomycosis)	(Gargani et al., 2011)
	<i>Penicillium</i> Species	Soil/Environment	Pulmonary Infection, Epidermal Invasion	Penicilliosis (Fever, Dry Cough, Skin Lesions)	(Gorai et al., 2019)
	<i>Fusarium</i>	Soil/Environment	Pulmonary Infection	Fusariosis (Fever, Neutropenia, Pneumonia, Sinusitis, Disseminated Disease in Immunocompromised)	(Dehal and Quimby, 2019)
	<i>Oxysporum</i>	Environment			
	<i>Escherichia coli</i>	Soil/Handling	Enteric Infection, Brain Stem	Meningitis in Infants, Enteritis, Diarrhea	(Kim, 2016; Crofts et al., 2018; Valilis et al., 2018)
	<i>Salmonella</i>	Soil/Handling	Enteric Infection	Diarrhea, Vomiting, Fever, Enteritis	(Daley et al., 2013)
	<i>Clostridium</i>	Soil/Handling	Enteric Infection	Botulism (cranial nerve palsies, flaccid paralysis of voluntary muscles, respiratory compromise, death)	(Sobel, 2005)
Heavy Metals	Cadmium	Soil	Systemic	Periodontal Disease, Pancreatic Cancer, Diabetes, Itai-Itai Disease	(Kasuya et al., 1992; Buha et al., 2017; Tinkov et al., 2017; Browar et al., 2018)
	Lead	Soil	Systemic	Neurotoxic, Peripheral Neuropathy, Loss of Appetite and Weight, Chronic Fatigue	(Marchetti, 2013; Mason et al., 2014)
	Mercury	Soil	Systemic	Forgetfulness, Irritability, Restricted Visual Fields, Tremors, Paranoia	(Siegel et al., 1988)
Insecticides	Bifenazate	Applied During Growth	Unknown	Weight Loss and Gain	(Zarn and O'brien, 2017)
	Abamectin	Applied During Growth	GABA Mimetic Toxic Effects	Disruption of Synaptic Processes	(Da Silva et al., 2018)
Fungicides	Imazalil	Applied During Growth	Androgen Receptor Agonist and Endocrine Disruptor in Mammals	Abnormal Hormone Production	(Goetz et al., 2009)
	Myclobutanil	Applied During Growth	Inhibit Cholesterol Synthesis in Mammals	Not Known for Humans	(Hester et al., 2006; Berenstein et al., 2017)
Plant Growth Regulator	Daminozide	Applied During Growth	Unknown	Considered a Human Carcinogen	Neff and Goldman, 2005)
	Paclobutraxol	Applied During Growth	Disrupt Neurotransmitter Levels in Mammals	Not Known for Humans	(Li et al., 2012; Xu and Yang, 2020)
Polycyclic Aromatic Hydrocarbons	PAHs	Ubiquitous Environmental Toxins	DNA Adducts, Histone Alteration, DNA Methylation	Carcinogenic	(Abdel-Shafy and Mansour, 2016)

Adulterations and Labeling

(Geoffrey et al, 2021) this study analyzed 133 products (oils, tinctures, powders, edibles, beverages, gummies, honey, candy)
*Study is not representative of the Hemp or CBD products but raises questions and concerns for additional study into accuracy.

Wide range of CBD concentrations with nine products not containing CBD

Toxic elements such as (Pb), (Cd), (Hg) and (As) – Pb was the highest in all product categories < the LOG in vast majority of samples

43 products (29%) labeling claimed to be THC free, of these 8 samples contained quantifiable amounts of THC

Authors noted that “fewer than half of the tested products which presented label claims contained CBD at concentrations within 20% of their claimed amount”



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Today's Panelists

Moderated by: Tara Casanova Powell, *Association of Traffic Safety Information Professionals*



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*Center for Forensic
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and Education*



Dr. Michelle Peace,
*Virginia Commonwealth
University*



Darrin Grondel,
*Foundation for Advancing
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