

Northwest (HHS Region 10)



Addiction Technology Transfer Center Network Funded by Substance Abuse and Mental Health Services Administration



Northwest ATTC presents: Time Trends in Cannabis Use, Cannabis Use Disorder and Psychiatric Comorbidity: Individual and State-Level Influences

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Northwest ATTC presents:

Time Trends in Cannabis Use, Cannabis Use Disorder and Psychiatric Comorbidity: Individual and State-Level Influences



Deborah Hasin, PhD (Columbia University)



Time Trends in Cannabis Use, Cannabis Use Disorder and Psychiatric Comorbidity: Individual & State-Level Influences





Deborah Hasin, Ph.D. Columbia University New York State Psychiatric Institute October 18, 2023



Presentation overview

- Potential benefits and harms of adult cannabis use
- Definitions of Cannabis Use Disorder (CUD)
- The changing cannabis "landscape": Potential environmental influences on the prevalence of adult cannabis use and CUD
- Time trends in the prevalence of adult CUD
- State medical and recreational cannabis laws and adult CUD
- CUD trends by comorbidity
 - Chronic pain
 - Psychiatric disorders

Cannabis: Potential individual & societal benefits



Potential individual benefits:

- Enjoyment
- To treat medical conditions, e.g. pain, nausea in cancer patients, epilepsy, obesity, AIDS wasting disease, addiction to other substances, autoimmune disorders
- Civil liberties, freedom from fear of arrest

Potential societal benefits:

- Social justice aims
- Business and job growth
- State and local tax revenue

A potential benefit? cannabis as treatment for medical conditions: meta-analysis of randomized clinical trials

				Stu	dies				
Author, year	Cannabinoid specific exposur	Outcome e	(k)	No	Certaint	У	eOR (95% CI)		eOR (95% CI)
Chronic pain									
Mucke 2018	CBM	Psychological distress	10	751	м			•	1.76 (1.03 to 3.05)
Stockings 2018	CBM	Pain 30% reduction	9	1734	4 Н		•		0.59 (0.37 to 0.93)
Stockings 2018	CBM	Pain, change in pain scores	34	3866	5 M		-+-		0.73 (0.60 to 0.90)
Andreae 2015	Cannabis (inhaled	Pain reduction	9	520	м				0.32 (0.19 to 0.52)
Multiple sclerosis									
Da Rovare 2017	Cannabiods	Dizziness	14	2763	3 M			++	3.45 (2.72 to 4.37)
Da Rovare 2017	Cannabiods	Somnolence	11	1911	М			♦ →	2.90 (1.98 to 4.23)
Da Rovare 2017	Cannabiods	Dry mouth	10	2390	М			_	2.82 (2.06 to 3.85)
Da Rovare 2017	Cannabiods	Nausea	11	1797	7 M				2.24 (1.61 to 3.12)
Torres-Moreno 20	18 CBM	Pain reduction	12	2692	2 M				0.71 (0.53 to 0.94)
Torres-Moreno 20	18 CBM	Spasticity (subjective)	12	2909	м	· ·	-•		0.63 (0.51 to 0.80)
Inflammatory boy	vel disease								
Doeve 2020	Cannabiods	Quality of life	5	2444	4 Н	← •──	-		0.34 (0.22 to 0.53)
Cancer									
Noori 2021	CBM	Vomiting	4	1334	4 M			_	1.50 (0.99 to 2.27)
Noori 2021	CBM	Nausea	4	1334	4 M			_	1.43 (1.03 to 1.96)
Noori 2021	CBM	Constipation	3	1157	7 M				0.85 (0.54 to 1.35)
Hauser 2019	CBM D	aily break-through opioid dosage	4	971	м		-+-	-	0.82 (0.64 to 1.05)
Hauser 2019	CBM	Pain intensity	7	1331	M			- J	0.81 (0.61 to 1.06)
					0	.25	1	1 4	
					В	eneficial		Harmful	

A potential benefit? cannabis as treatment for medical conditions: meta-analysis of randomized clinical trials

				Stu	dies		
Author, year	Cannabinoid specific exposur	Cannabinoid Outcome specific exposure		No	Certainty	/ eOR (95% CI)	eOR (95% CI)
Chronic pain							
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Stockings 2018	CBM	Pain 30% reduction	9	1734	н		0.59 (0.37 to 0.93)
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Andreae 2015	Cannabis (inhaled	Pain reduction	9	520	м	← ● ───	0.32 (0.19 to 0.52)
Multiple sclerosis	i						
Da Rovare 2017	Cannabiods	Dizziness	14	2763	в м		- + 3.45 (2.72 to 4.37)
Da Rovare 2017	Cannabiods	Somnolence	11	1911	м		→ 2.90 (1.98 to 4.23)
Da Rovare 2017	Cannabiods	Dry mouth	10	2390	м (•	2.82 (2.06 to 3.85)
Da Rovare 2017	Cannabiods	Nausea	11	1797	/ М	+	- 2.24 (1.61 to 3.12)
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Hauser 2019	CBM D	aily break-through opioid dosage	e 4	971	м		0.82 (0.64 to 1.05)
Hauser 2019	CBM	Pain intensity	7	1331	м	→ _ <u>+</u>	0.81 (0.61 to 1.06)
					01	25 1	4
					Ве	eneficial Har	mful

A potential benefit? cannabis as treatment for medical conditions: meta-analysis of randomized clinical trials

Study or Subgroup	Place Events	bo Total	CBM Events	Total	Weight	Risk Difference M-H, Random, 95% CI	Risk Difference M-H, Random, 95% CI	
6.1.1 Acute pain Jochimsen 1978 Subtotal (95% CI)	40	70	16	35	100.0N 100.0%	0.11 [-0.09, 0.32]		ute pain
Total events Heterogeneity: Not ap Test for overall effect:	40 plicable Z = 1.11	(P = 0	16 .27)					
6.1.2 Cancer pain 2-	S weeks							
Johnson 2010	23	60	12	58	41.3%	0.18 [0.02, 0.34]	——	
Portenoy 2012 Subtotal (95% CI)	78	268 328	24	91 149	58.7% 100.0%	0.03 [-0.08, 0.13] 0.09 [-0.06, 0.23]		ncer pain
Total events Heterogeneity: Tau ⁴ = Test for overall effect:	101 0.01; Ch Z = 1.21	r = 2.5	36 10, df = 1 .23)	1 (P -	0.13); r ²	- 57N		
6.1.3 Neuropathic pa	in <1 da	Y						
Wilsey 2013	43	73	10	38	49.4%	0.33 [0.15, 0.51]		Nouropathia pain <1 day
Wilsey 2016 Subtotal (95% CI)	61	79 152	18	41 79	50.6N 100.0%	0.33 [0.16, 0.51] 0.33 [0.20, 0.46]	(🛨)	Neuropathic pairi <1 day
Total events Heterogeneity: Tau ² - Test for overall effect:	104 0.00; Ch Z = 5.11	1 ² = 0.0 (P < 0	28 0, df = 1 .00001)	1 (P -	0.96); r ²	- 0N		
6.1.5 Neuropathic pa	in >4 we	eks						
Andresen 2016	3	34	6	34	19.6N	-0.09 [-0.25, 0.07]		
NCT00710424	54	149	59	148	27.9%	-0.04 [-0.15, 0.07]		wanathia nain Sitwaaka
Nurmikko 2007	16	63	9	62	22.8%	0.11 [-0.03, 0.25]		uropathic pain >4 weeks
Serpell 2014 Subtotal (95% CI)	34	128 374	19	118 362	29.7% 100.0%	0.10 [0.00, 0.21] 0.03 [-0.07, 0.12]		
Total events Heterogeneity: Tau ² = Test for overall effect:	107 0.01; Ch Z = 0.59	a ² = 6.0	93 1, df = 1 .55)	3 (P -	0.08); r ²	= 56N	\times	
616 MS pain >4 we	ake							
Langford 2013 Subtotal (95% CI)	84	167	77	172	100.0%	0.06 [-0.05, 0.16]	(🛓) мз	pain >4 weeks
Total events Heteropenetty: Not an	84 olicable		77					
Test for overall effect	z = 1.02	(P = 0	.31)					
6.1.7 MS spasticity p	ain outco	ome						
Zajkek 2012 Subtotal (95% CI)	28	94 94	9	80 80	100.0% 100.0%	0.19 [0.07, 0.30] 0.19 [0.07, 0.30]	(💷) M	S pain spasticity
Total events Heterogeneity: Not ap Test for overall effect:	28 plicable Z = 3.15	(7 = 0	9 .002)				\bigcirc	
6.1.8 MS progression	n							
Ball 2015 Subtotal (95% CI)	41	264 264	27	148 148	100.0%	-0.03 [-0.10, 0.05] -0.03 [-0.10, 0.05]	🛛 🌔 📮 🔪 MS i	rogression
Total events Heterogeneity: Not ap Test for overall effect:	41 plicable	(7 - 0	27					
		•					-0.5 -0.25 0 0.25 0.5	
Fisher	r E A	at e	<u>ا</u> د	P	ain '	2021	Placebo Cannabis	
1 13/101			<i></i>			2021	Better Better	

Additional review of cannabis for pain in randomized clinical trials

Outcomes	N	RCT Type	Summary
Overall Chronic pain	151	RCT	Little to no difference compared to placebo
Overall Chronic pain	63	Parallel	Possible slight pain reduction
Overall Chronic pain	90	Crossover	Little to no difference compared to placebo
Fibromyalgia	83	RCT	Pain reduction uncertain
Fibromyalgia	58	Parallel	Slight pain reduction

Giossi R et al., Pain Ther 2022

Why are the study results so different from people's beliefs?

VIEWPOINT

Cannabis and Cannabinoids for Pain and Posttraumatic Stress Disorder in Military Personnel and Veterans

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jamapsychiatry.com

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Aaron S. Wolfgang, MD

Department of Psychiatry, Uniformed Services University, Bethesda, Maryland; and Department of Psychiatry, Yale University School of Medicine, New Haven, Connecticut.

Charles W. Hoge, MD Walter Reed Army Institute of Research, Silver Spring, Maryland.

- Reviewed 56 randomized clinical trials for pain
- Unusually high positive response in *placebo* groups
- This response suggests that reported improvements in pain may be attributable to a placebo effect or favorable expectancies of cannabinoid effects rather than a biological treatment effect
- This becomes an issue if cannabis has adverse secondary conseugences

Cannabis: potential harms

- First things first: cannabis does not have the same morbidity/mortality profile of opioids
- However, cannabis is not a harmless substance

Meta-analysis: observational studies of harms of cannabis in pregnant women, drivers, & patients with psychosis

				Studies			
Author, year	Cannabinoid specific exposure	Outcome	(k)	n/No	CE/CES	eO R (9 5% CI)	eOR (95% CI)
Pregnant wome	n						
Marchant 2022	Marijuana use	Small for gestational age	6	2078/22 921	1/1	*	1.61 (1.41 to 1.83)
Conner 2016	Marijuana use	Low birth weight	12	6204/57 438	I/I	*	1.43 (1.27 to 1.62)
Marchant 2022	Marijuana use	Neonatal ICU admission	6	1315/18 615	i III/III	•	1.41 (1.15 to 1.71)
Conner 2016	Marijuana use	Pre-term delivery	14	8060/81 326	5 111/111	•	1.32 (1.14 to 1.54)
Drivers							
Rogeberg 2019	THC positive	Car crash, culpability	13	NR/78 025	IV/I	+	1.53 (1.39 to 1.67)
Rogeberg 2019	THC positive	Car crash	13	NR/78 025	IV/I	•	1.27 (1.21 to 1.34)
Hostiuc 2018	Cannabis use	Car unfavourable traffic events	23	NR/245 021	IV/II	*	1.89 (1.58 to 2.26)
Hostiuc 2018	Cannabis use	Car death after car crash	5	NR/66 705	IV/II	•	1.72 (1.40 to 2.10)
Hostiuc 2018	Cannabis use	Car injury	12	NR/95 441	IV/III	-+-	2.15 (1.42 to 3.28)
Hostiuc 2018	Cannabis use	Car collision	6	NR/82 875	IV/III	-+-	1.91 (1.34 to 2.72)
Psychosis							
Foglia 2017	Cannabis current use	Adherence to antipsychotic treatment	3	NR/259	IV/III		5.78 (2.68 to 12.46)
Foglia 2017	Cannabis any use	Adherence to antipsychotic treatment	11	NR/3055	IV/III	+	2.46 (1.97 to 3.07)
Bogaty 2018	Cannabis current use	PremorbidIQ	7	NR/515	IV/III	-+-	1.99 (1.34 to 2.96)
Schoeler 2016	Cannabis continued use	Psychosis relapse	24	NR/16 257	IV/III	-+-	1.88 (1.34 to 2.71)
Schoeler 2016	Cannabis use	Working memory	19	NR/2468	IV/III	•	1.44 (1.21 to 1.71)
					0.06	525 1 1	6
					Ben	eficial Harmf	ul

Meta-analysis – adverse outcomes of cannabis in pregnant women, drivers, & patients with psychosis

				Studies			
Author, year	Cannabinoid specific exposure	Outcome	(k)	n/No	CE/CES	eOR (95% CI)	eOR (95% CI)
Pregnant women	n						2
Marchant 2022	Marijuana use	Small for gestational age	6	2078/22 921	1/1	*	1.61 (1.41 to 1.83)
Conner 2016	Marijuana use	Low birth weight	12	6204/57 438	I/I	*	1.43 (1.27 to 1.62)
Marchant 2022	Marijuana use	Neonatal ICU admission	6	1315/18 615	5 111/111	•	1.41 (1.15 to 1.71)
Conner 2016	Marijuana use	Pre-term delivery	14	8060/81 326	5 111/111	•	1.32 (1.14 to 1.54)
Drivers							5
Rogeberg 2019	THC positive	Car crash, culpability	13	NR/78 025	IV/I	•	1.53 (1.39 to 1.67)
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Hostiuc 2018	Cannabis use	Car death after car crash	5	NR/66 705	IV/II	*	1.72 (1.40 to 2.10)
Hostiuc 2018	Cannabis use	Car injury	12	NR/95 441	IV/III		2.15 (1.42 to 3.28)
Hostiuc 2018	Cannabis use	Car collision	6	NR/82 875	IV/III	-+-	1.91 (1.34 to 2.72)
Psychosis							
Foglia 2017	Cannabis current use	Adherence to antipsychotic treatment	3	NR/259	IV/III		- 5.78 (2.68 to 12.46)
Foglia 2017	Cannabis any use	Adherence to antipsychotic treatment	11	NR/3055	IV/III	•	2.46 (1.97 to 3.07)
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Schoeler 2016	Cannabis continued use	Psychosis relapse	24	NR/16 257	IV/III	-+-	1.88 (1.34 to 2.71)
Schoeler 2016	Cannabis use	Working memory	19	NR/2468	IV/III	•	1.44 (1.21 to 1.71)
					0.06	525 1	16
					Ben	eficial Harm	ful

Meta-analysis – adverse outcomes of cannabis use in the general population and in healthy individuals

				Studies			
Author, year	Cannabinoid specific exposure	Outcome	(k)	n/No	CE/CES	eO R (95% CI)	eOR (95% CI)
General populat	tion						
Kiburi 2021	Cannabis	Psychosis	18	2512/67 684	∓ II∕II	•	1.71 (1.47 to 2.00)
Borges 2016	Cannabis heavy use	Suicide attempt	12	1066/21 956	5 111/111		
Moore 2007 C	annabis most frequent u	se Psychotic symptoms	6	1465/59 671	111/111		2.18 (1.45 to 3.27)
Gibbs 2015	Cannabis use	Mania symptoms	2	NR/5520	IV/III	-•	- 3.00 (1.73 to 5.23)
Gurney 2015	Cannabis weekly use	Testicular cancer non-seminoma	3	719/2138	IV/III		- 2.82 (1.77 to 4.48)
Gurney 2015	Cannabis >10 years use	Testicular cancer non-seminoma	3	719/2138	IV/III		- 2.39 (1.47 to 3.86)
Gurney 2015	Cannabis current use	Testicular cancer non-seminoma	2	532/1803	IV/III	-+-	2.20 (1.57 to 3.07)
Lorenzetti 2019	Cannabis regular use	Medial orbitofrontal cortex volume	6	NR/356	IV/III	-+-	1.72 (1.29 to 2.30)
Lorenzetti 2019	Cannabis regular use	Total orbitofrontal cortex volume	7	NR/472	IV/III	-+-	1.63 (1.31 to 2.03)
Johnson 2017	Cannabis use	Physical dating violence perpetuation	13	NR/17 356	IV/III	-+-	1.45 (1.19 to 1.77)
Meore 2007	Cannabis use	Depression	11	NR/17 628	IV/III	*	1.21 (1.11 to 1.31)
Healthy people							
Schoeler 2016	Cannabis use	Visual immediate recall	2	NR/89	IV/II		•- 3.76 (2.64 to 5.34)
Schoeler 2016	Cannabis use	Prospective memory	5	NR/294	IV/II		- 3.43 (2.23 to 5.28)
Schoeler 2016	Cannabis use	Verbal learning	41	NR/3085	IV/II	•	2.03 (1.72 to 2.39)
Schoeler 2016	Cannabis use	Verbal delayed recall	38	NR/3368	IV/II		1.95 (1.63 to 2.34)
Schoeler 2016	Cannabis use	Verbal immediate recall	40	NR/3169	IV/III	-+-	2.10 (1.52 to 2.97)
Schoeler 2016	Cannabis use	Verbal recognition	21	NR/1485	IV/III	-+-	1.69 (1.36 to 2.07)
Schoeler 2016	Cannabis use	Working memory	39	NR/4550	IV/III	*	1.29 (1.14 to 1.46)
					0.1	25 1	8
					Ber	neficial Ha	rmful

Cannabis use and incident psychotic disorder across Europe and Brazil: a multi-center case-control study, n=2,138



Cannabis potency exposure: high-potency: THC ≥10% low-potency: THC <10%

Cannabis comparison	Community controls N=1237	Psychotic patients N=901
Any lifetime use	46%	65%
High-potency use	19%	37%

DiForti et al, Lancet Psychiatry 2019

Cannabis use and incident psychotic disorder across Europe and Brazil: a multi-center case-control study, n=2138



DiForti et al, Lancet Psychiatry 2019; D'Souza et al., World J Bio Psychiatry

Increased risk found for other potential adverse outcomes of CUD or cannabis use

Outcome	Population	Citation
Cardiovascular events	59,528 Canadian residents	Bahji et al., Addiction 2023
Cannabinoid hyperemesis syndrome	55,549 U.S. inpatients	Patel et al., Psychosomatics 2019
Perioperative morbidity & mortality	12,422 U.S. non-cardiac inpatients	Potnuru et al., JAMA Surgery 2023
Psychotic and non-psychotic bipolar and unipolar disorder	6,651,765 Danish adults	Jefsen et al., JAMA Psychiatry 2023
Psychosocial problems	36,309 U.S. adults	Gutkind et al., Drug Alch Depen 2021
Cannabis use disorder, cannabis dependence	Multiple clinical and general population studies	Hasin et al., Am J Psychiatry 2013

DSM-IV and DSM-5 Cannabis Use Disorder Criteria

	DS	M-IV	DSM-5
	Abuse	Dependence	Cannabis Use Disorder
Diagnostic Criteria			
Failure to fulfill obligations	Х		Х
Hazardous use	Х		Х
Cannabis-related legal problems	Х		
Social/interpersonal substance-related problems	Х		Х
Tolerance		Х	Х
Withdrawal			Х
Persistent desire/unsuccessful efforts to cut down		Х	Х
Using more/longer than intended		Х	Х
Neglect of important activities		Х	Х
Great deal of time spent in cannabis-related activities		х	Х
Psychological/physical cannabis-related problems		Х	Х
Craving for cannabis			Х
Diagnostic Threshold	1+ criteria	3+ Criteria	Mild: 2-3 Moderate: 4-5 Severe: ≥6

Am Psychiatric Assn 2013; 2022; Hasin et al., Am J Psychiatry 2013

DSM-IV and DSM-5 Cannabis Use Disorder Criteria

	DS Abuse	SM-IV Dependence	DSM-5 Cannabis Use Disorder
Diagnostic Criteria			
Failure to fulfill obligations	Х		Х
Hazardous use	Х		Х
Cannabis-related legal problems	Х		
Social/interpersonal substance-related problems	Х		Х
Tolerance		Х	Х
Withdrawal			X
Persistent desire/unsuccessful efforts to cut down		Х	Х
Using more/longer than intended		Х	Х
Neglect of important activities		Х	Х
Great deal of time spent in cannabis-related activities		Х	Х
Psychological/physical cannabis-related problems		Х	Х
Craving for cannabis			X
Diagnostic Threshold	1+ criteria	3+ Criteria	Mild: 2-3 Moderate: 4-5 Severe: ≥6

Am Psychiatric Assn 2013; 2022; Hasin et al., Am J Psychiatry 2013

Risk of Cannabis Use Disorder Among Individuals Who Use Cannabis

	Addictive Behaviors 109 (2020) 106479					
	Contents lists available at ScienceDirect	ADDICTIVE BEHAVIORS				
19.20	Addictive Behaviors	An INTERNATIONAL COMMON				
ELSEVIER journal homepage: www.elsevier.com/locate/addictbeh						
What is the p	prevalence and risk of cannabis use disorders among people who					
use cannabis	s? a systematic review and meta-analysis	Check for updates				
Janni Leung ^{a,b,a}	*, Gary C.K. Chan ^b , Leanne Hides ^{a,b} , Wayne D. Hall ^b					
^a School of Psychology, Live ^b Centre for Youth Substant	es Lived Well Group, The University of Queensland, Australia ce Abuse Research, The University of Queensland, Australia					
HIGHLIGHTS						
• There is a global cl	if towards cannable legalization and underestimation of harms.					
 People who use car 	w meta-analysed the risk of cannabis use disorders (CCO) from use. nnabis have a 1 in 5 risk of developing a CUD.					
 reisks increase if ca The public needs to 	nnabis is initiated early and used frequently. The informed about the risks of developing CUD from cannabis use.					

Risk for cannabis use disorder by frequency of use at initial assessment: data from 6 studies, 40,984 study participants, 3-17 years later

Initial cannabis use frequency	Relative risk of Cannabis Use Disorder							
Never	reference							
1-11 days/year (yearly)	2.03							
1-3 days/month (monthly)	4.12							
1-4 days/week (weekly)	8.37							
5-7 days/week (daily)	16.99							
Significance of overall model: p<0.0001								

Robinson T et al., Drug Alch Depend, 2022

At least 3 of these symptoms develop within a week after cessation of heavy, prolonged use:

- Depressed mood
- Decreased appetite or weight loss
- Sleep difficulty (i.e., insomnia, disturbing dreams)
- Restlessness
- Nervousness or anxiety
- Irritability, anger or aggression
- ≥1 of the following: abdominal pain, shakiness/tremors, sweating, fever, chills, headache

Symptoms cause distress or impairment, and are not attributable to another medical condition or another mental disorder, including intoxication or withdrawal from another substance.

Cannabis withdrawal in DSM-5-TR: overlap with symptoms of psychiatric disorders

At least 3 of these symptoms develop within a week after cessation of heavy, prolonged use:

- Depressed mood
- Decreased appetite or weight loss
- Sleep difficulty (i.e., insomnia, disturbing dreams)
- > Restlessness
- Nervousness or anxiety
- Irritability, anger or aggression
- ≥1 of the following: abdominal pain, shakiness/tremors, sweating, fever, chills, headache

Patients may perceive cannabis as effective for treating symptoms of psychological problems because the symptoms decrease when they use cannabis, when what they are actually doing is perpetuating ongoing cannabis withdrawal

Potential influences on the prevalence of cannabis use and CUD: The changing cannabis landscape



- Changing attitudes and beliefs
- Changing product potency
- Changing state cannabis laws & legal availability
- Commercialization (marketing, advertising)

Average △-THC⁹ Concentration of Illicit Cannabis Samples Seized by DEA, 1995-2014, 2008-2017



ElSohly et al., 2016; 2021



Select ALL THAT APPLY

SMOKING (examples - pipes, bongs, joints, blunts, spliffs, etc ...)



15%-20%

using CONCENTRATES with a VAPORIZER (examples - oils or dabs like wax, shatter, etc...)



40%-80%

using BUDS/PLANT MATERIAL with a VAPORIZER



15%-20%

by using CONCENTRATES with a DAB RIG (examples - oils or dabs like wax, shatter, etc...).



40%-80%

- Types of products and routes of administration have changed
- Now much stronger than in earlier years (Spindle et al., 2019)

Status of cannabis in the U.S.

- In 1800s, marijuana used for many medical purposes, but became less important with development of synthetic painkillers
- Public view transformed in 1930s after Mexican immigrants introduced recreational marijuana; anti-marijuana and anti-immigrant views sometimes blended
- 1936 <u>Am J Nursing</u>: "marijuana user will suddenly turn with murderous violence on whoever is near...run amuck with knife, ax, gun"



- <u>Public propaganda</u>: Reefer Madness ("the burning weed with its roots in hell" <u>https://www.youtube.com/watch?v=sbjHOBJzhb0</u>), scare tactics
- Public opinion has fluctuated markedly over time

Trends in no perceived risk of cannabis attitudes, adults age 18+, 2002-2018, NSDUH



Compton et al., Lancet Psychiatry 2016

Trends in perceiving great risk of cannabis use, adults age 18+, 2002-2018, NSDUH



Compton et al., Lancet Psychiatry 2016

Trends in perceived risk: differ by substance

- Perceived risk of alcohol, cocaine, heroin, cigarettes higher than cannabis, and stable over time
- Perceived risk of cannabis use decreasing over time



GALLUP polls of U.S. adults: should marijuana be legal for recreational use?

U.S. Support for Legalizing Marijuana, 1969-2021

Do you think the use of marijuana should be legal, or not?



November, 2021

States with medical cannabis laws (MCL) and recreational cannabis laws (RCL)



As of today:

- Recreational marijuana is legal for adults in 21 states + D.C.
- Medical marijuana is legal in 39 states + D.C.

Cannabis industry and commercialization – U.S.



Time Trends in Cannabis Use and Cannabis Use Disorder among U.S. adults



Trends in **12-month** prevalence of marijuana use among MTF adult panel respondents, modal age 19-50, by age group



http://monitoringthefuture.org/pubs/monographs/mtfpanelreport2022

Trends in prevalence of **daily** marijuana use among MTF adult panel respondents, modal age 19-50, by age group



http://monitoringthefuture.org/pubs/monographs/mtfpanelreport2022

Adult prevalence of past-year cannabis use & cannabis use disorder, 2001-2002 & 2012-2013



Hasin et al., JAMA Psychiatry 2015

Adult cannabis use and DSM-5 cannabis use disorders 2002-2017, NSDUH



- DSM-IV CUD remained stable, while use and daily use increased
- DSM-5 CUD (proxy; 2 of 9 criteria) increased, with increases seen in the mild category; DSM-5 considered "more sensitive"
- DSM-5 craving and withdrawal missing in NSDUH, so unclear how results would have looked if these were included

Veterans Health Administration: Health Data

- Veterans Health Administration (VHA): the largest integrated healthcare system in the U.S.
- 9 million patients enrolled who were veterans in the U.S. armed forces
- VHA Electronic Health Records (EHR) data include medical and psychiatric diagnoses, treatment, prescriptions, mortality etc.
- These data are used for a wide variety of research purposes
- We have used VHA data to study CUD prevalence trends and associations

ICD-9-CM and ICD-10-CM Cannabis Use Disorder: Veterans Administration Patients, 2005-2019



Hasin et al, Am J Psychiatry 2022



How could more permissive cannabis laws increase cannabis use (and harms)?

By increasing desirability.

- Signaling that because cannabis use is legal, it is safe
- Permitting advertising
- Reducing disapproval & perceived harmfulness.

By increasing availability.

• Via dispensaries, retail outlets, online sources, home delivery, home cultivation

By permitting an emerging for-profit cannabis industry

- Aims to increase the numbers of consumers
- Aims to increase the amounts that consumers use

Recreational cannabis laws (RCL), marijuana use and DSM-IV CUD NSDUH surveys, 2008-2016 (n=495,796)

	Age groups	Any marijuana use		Frequent use			DSM-IV Cannabis use disorder			
		% Pre RCL	% Post RCL	aORª	% Pre RCL	% Post RCL	aORª	% Pre RCL	% Post RCL	aORª
	12-17	4.76	5.28	1.12	1.07	1.19	1.12	2.18	2.72	1.25*
	18-25	13.06	14.03	1.09	4.64	5.08	1.10	3.62	3.48	0.96
	26+	5.65	7.10	1.28*	2.13	2.62	1.24*	0.90	1.23	1.36*
	 aOR = odds ratios, compared to non-RCL states, adjusted for individual, state sociodemographics * p<0.05 									

Cerdá et al., JAMA Psychiatry 2020

State Medical and Recreational Cannabis Laws and Risk of CUD in VHA patients

- Veterans Health Administration (VHA) patients are an important atrisk population for CUD due to high rates of psychiatric disorders and chronic pain
- Research question: Did state MCL and RCL play a role in the increasing CUD prevalence in VHA patients?

Methods: VHA electronic health records (EHR), 2005-2019

- Sequential yearly EHR data from each year
- Sample: 3.2-4.6 million patients each year with ≥1 VHA primary care, emergency, or mental health visit in that year
- Measures: CUD diagnoses according to ICD-9-CM & ICD-10-CM
- Analysis:
 - <u>Linear binomial regression</u>: to derive adjusted prevalence rates of CUD, 2005-2019, grouped by 2019 state law status
 - <u>Difference-in-difference (DiD) analysis</u>: to estimate change in state CUD rates pre- and post-MCL and RCL enactment, adjusted for overall national trends

Trends in CUD prevalence in VHA patients, 2005 - 2019, by state cannabis law status at the end of 2019



Hasin et al., JAMA Psychiatry 2023

Percent Of Total Increase In CUD Prevalence Accounted For By MCL and RCL: Age 18-75



From results in Hasin et al., JAMA Psychiatry 2023

Percent Of Total Increase In CUD Prevalence Accounted For By MCL and RCL: Age 18-34

• Results were not significant for those aged 18 - 34

Hasin et al., JAMA Psychiatry 2023

Percent Of Total Increase In CUD Prevalence Accounted For By MCL and RCL: Age 35-64



Hasin et al., JAMA Psychiatry 2023

Percent Of Total Increase In CUD Prevalence Accounted For By MCL and RCL: Age 65-75



Hasin et al., JAMA Psychiatry 2023

Trends in CUD prevalence in VHA patients by clinical comorbidity



Trends in CUD diagnoses, 2005-2019, VHA patients, by chronic pain (diagnoses of medical conditions associated with pain)



Mannes Z et al., Pain 2023

CUD prevalence in VHA patients with and without chronic pain, by state cannabis law status at the end of 2019



Hasin et al., Lancet Psychiatry 2023

Trends in CUD diagnoses, VHA patients by most common psychiatric disorders, 2005-2019



Livne et al., in press, Am J Psychiatry

Trends in CUD diagnoses, VHA patients by most common psychiatric disorders, 2005-2019



Hatch marks at 2015 indicate that this year was not included in models due to a change in ICD coding

Livne et al., In press, Am J Psychiatry

Strengths, Limitations, and Future Research Directions

- <u>Strengths</u>: N's of 3.2-4.5 million/year; many years of data; important, vulnerable population; findings robust to 1-year lags and legally permitted dispensaries
- <u>Limitations</u>: CUD diagnoses made by providers; may have missed milder cases; VHA patients are not nationally representative
- Future Research Directions
 - Influence of comorbidity on MCL/RCL effects
 - MCL/RCL effects on opioid and other outcomes
 - Study cohorts of patients to examine change in prescribed opioids or psychotropic medications on subsequent risk for incident CUD

Study Implications

- The need is increasing for screening & treatment of CUD, especially in patients with chronic pain and with psychiatric disorders
- This need may be greater in MCL and RCL states
- Discussions with patients about cannabis use need to take into account widespread beliefs in its safety and efficacy which may be fostered by a growing for-profit cannabis industry using techniques used by the tobacco and opioid industries

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Contact information: <u>dsh2@cumc.Columbia.edu</u> Deborah.hasin@gmail.com



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