U.S. Cannabis Use and Cannabis Use Disorder in a Changing U.S. Cannabis Landscape

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Presentation topics

- Long term changes in U.S. substance landscapes
- Cannabis use: potential benefits and harms
- Diagnosis of Cannabis Use Disorder (CUD)
- Time trends: adolescent cannabis use
- Time trends: adult use and CUD
  - Overall, and by chronic pain, psychiatric disorders, state cannabis legalization
- Implications

Opium, Cocaine and Marijuana in American History: Long-Term Changes

"Dramatic shifts in attitude have characterized America's relation to drugs." Peaks of these episodes are about a lifetime apart, so citizens rarely have an accurate recollection of the last wave."

Scientific American, 1991

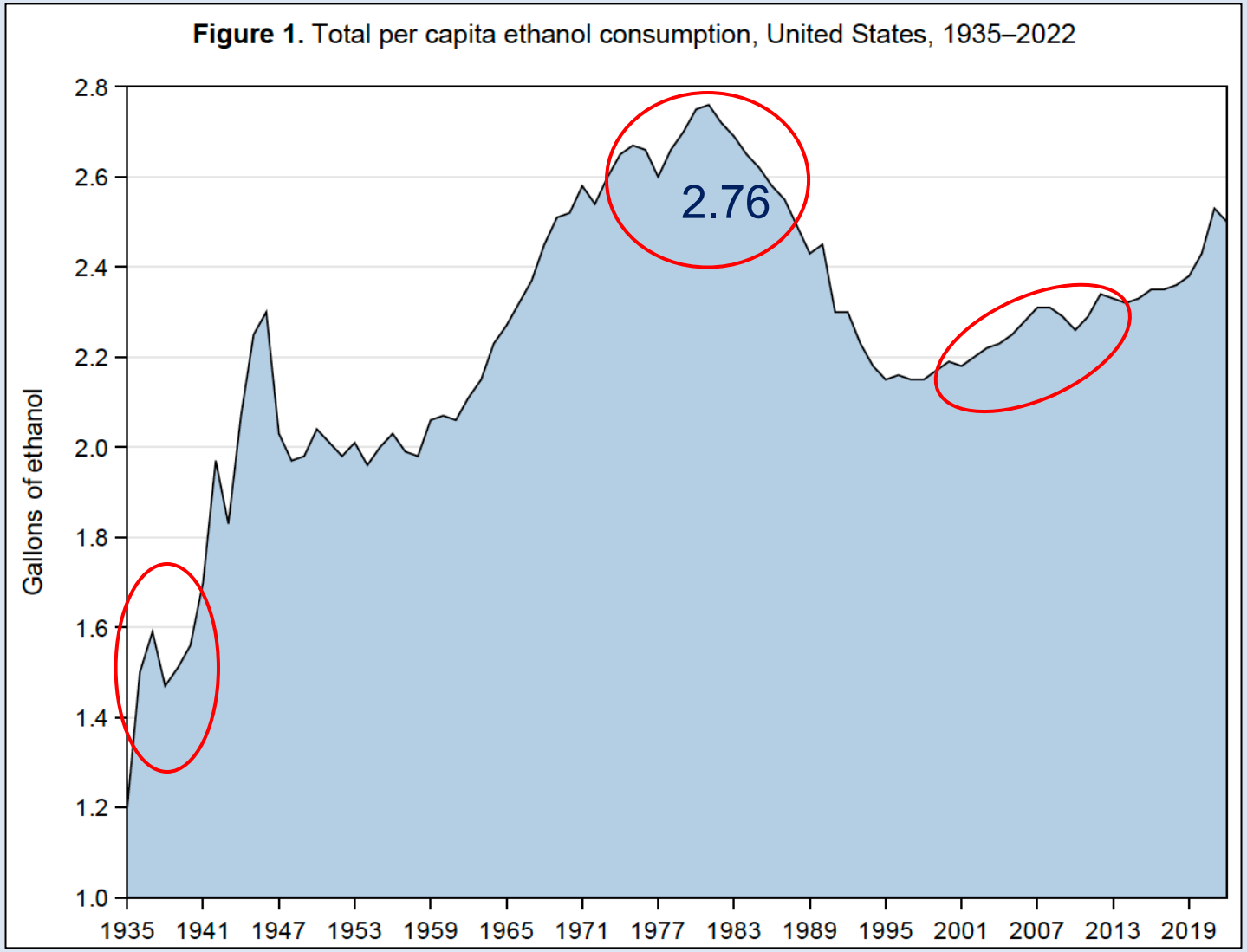
These shifts in attitudes about the harms and benefits of different substances apply to alcohol, opioids and cannabis, as well as cigarettes and cocaine.

David Musto, Ph.D.

Data discussed (all U.S. data)

Datasets (sample size)	Data Source	Years	Population
NESARC (n=43,093)	National Epidemiologic Survey on Alcohol & Related Conditions	2001-2002	General population age 18+
NESARC-III (n=36,309)	National Epidemiologic Survey on Alcohol & Related Conditions – III	2012-2013	General population age 18+
NSDUH (n ~ 60,000 yearly)	National Survey on Drug Use & Health	2002-2024	General population age 18+
MTF (n ~ 45,000 yearly)	Monitoring The Future surveys	1976-2024	Students age 13-19, many followed into adulthood
VHA (~ 9,000,000 patients yearly)	Veterans Health Administration electronic medical records	2005-2024	Patients age 18+ treated at VHA settings

Long-term changes in U.S. per capita alcohol consumption, 1935 – 2022: alcohol beverage sales data



Slater M, Alpert H, NIAAA Surveillance Report #121

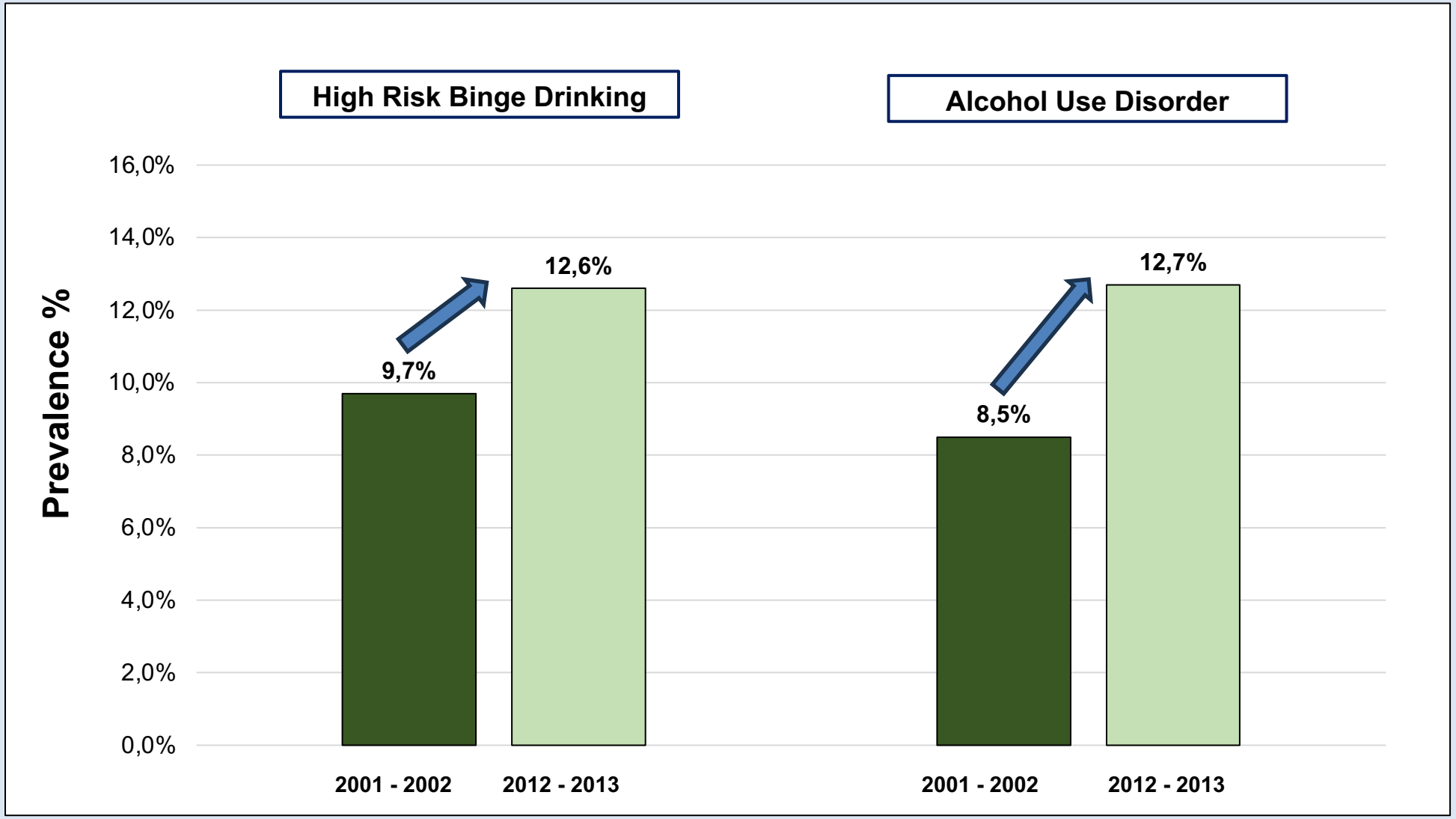
Current shift in thinking:

From: "Moderate drinking is good for your health"

To: Even low drinking levels can have health risks

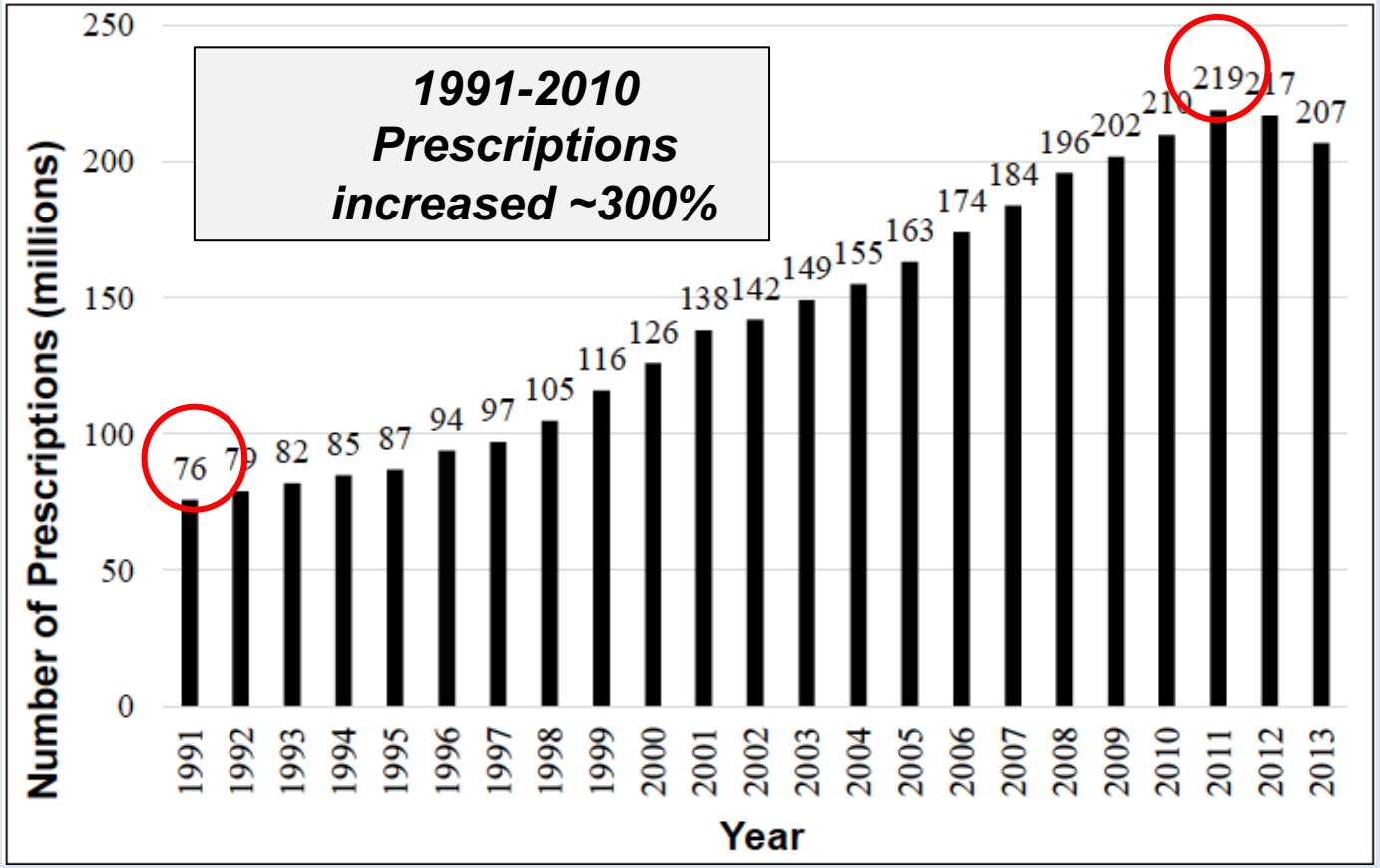
(Shield K, Keyes K et al., 2025)

Changes in Prevalence of Binge Drinking and Alcohol Use Disorder in U.S. Adults NESARC (2001-2002) and NESARC-III (2012-2013)



Grant BF et al., JAMA Psychiatry 2017

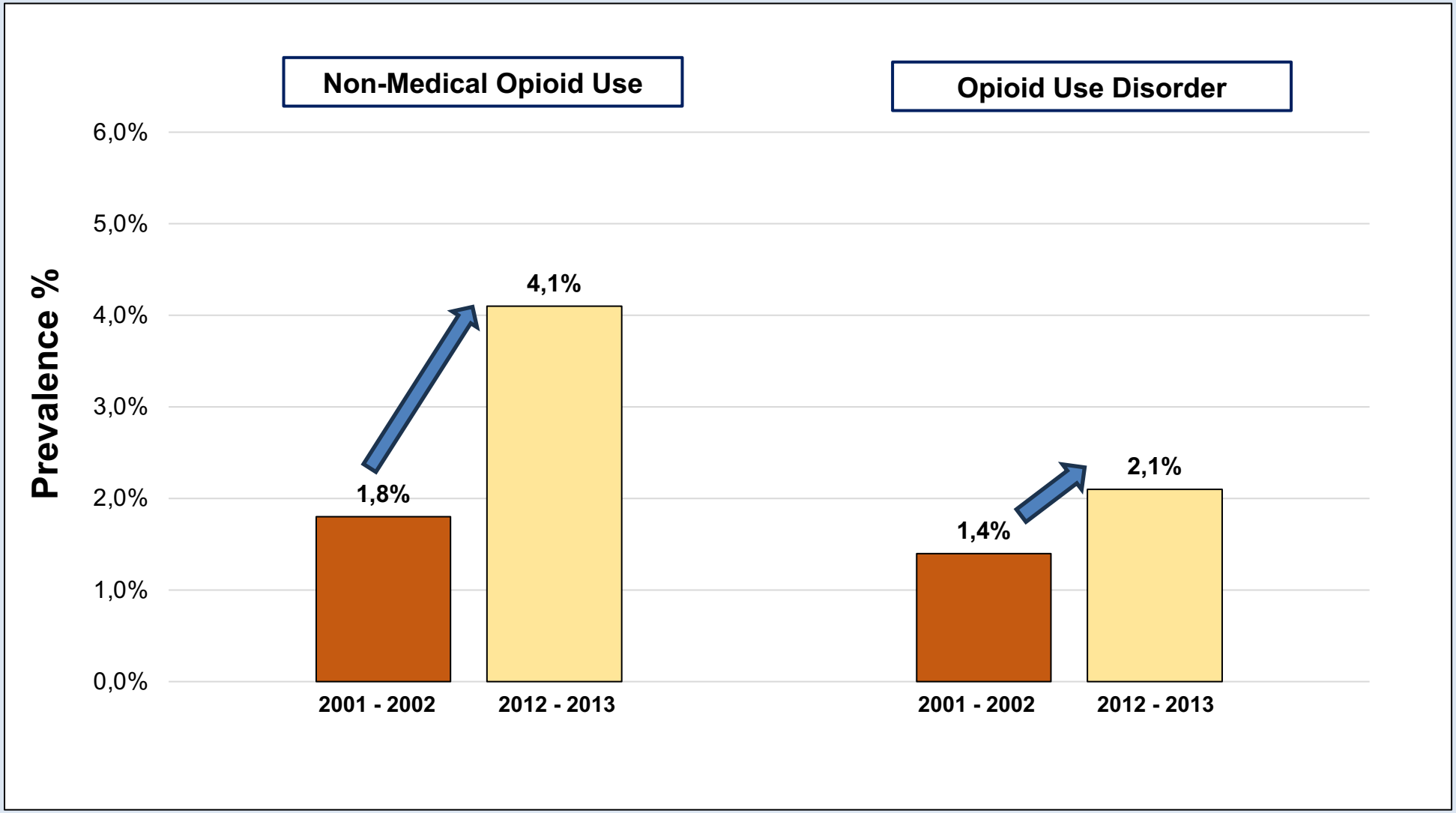
Changes in U.S. opioid prescriptions dispensed, 1991 - present



2023:
~125 million opioid prescriptions dispensed

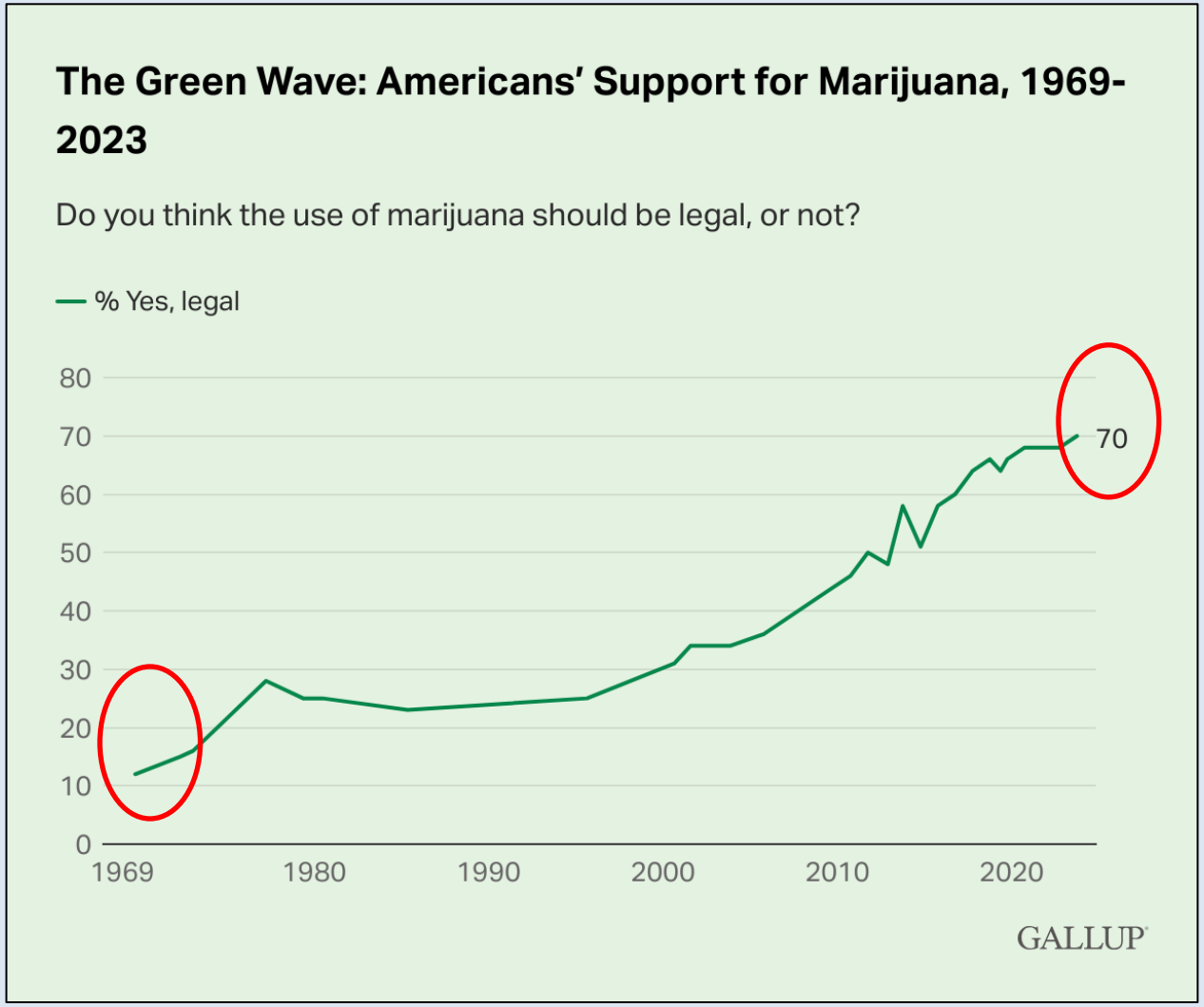
Prescriptions declined from the peak in 2011, but remain very high

Changes in Prevalence of Non-Medical Opioid Use and Opioid Use Disorder in U.S. Adults NESARC 2001-2002 and NESARC-III 2012-2013



Saha T et al., J Clin Psychiatry 2016

Changes in public opinion on legalization: GALLUP polls of U.S. adults



November, 2023

The federal government (Drug Enforcement Administration): 5 "schedule levels" according to risks and benefits

(1) Schedule I.--

(A) The drug or other substance has a high potential for abuse.

(B) The drug or other substance has no currently accepted medical use in treatment in the United States.

(C) There is a lack of accepted safety for use of the drug or other substance under medical supervision.

ILLEGAL DRUGS

e.g. heroin, marijuana

(2) Schedule II.--

(A) The drug or other substance has a high potential for abuse.

(B) The drug or other substance has a currently accepted medical use in treatment in the United States or a currently accepted medical use with severe restrictions.

(C) Abuse of the drug or other substances may lead to severe psychological or physical dependence.

(3) Schedule III.--

(A) The drug or other substance has a potential for abuse less than the drugs or other substances in schedules I and II.

(B) The drug or other substance has a currently accepted medical use in treatment in the United States.

(C) Abuse of the drug or other substance may lead to moderate or low physical dependence or high psychological dependence.

(4) Schedule IV.--

(A) The drug or other substance has a low potential for abuse relative to the drugs or other substances in schedule III.

(B) The drug or other substance has a currently accepted medical use in treatment in the United States.

(C) Abuse of the drug or other substance may lead to limited physical dependence or psychological dependence relative to the drugs or other substances in schedule III.

(5) Schedule V.--

(A) The drug or other substance has a low potential for abuse relative to the drugs or other substances in schedule IV.

(B) The drug or other substance has a currently accepted medical use in treatment in the United States.

(C) Abuse of the drug or other substance may lead to limited physical dependence or psychological dependence relative to the drugs or other substances in schedule IV.

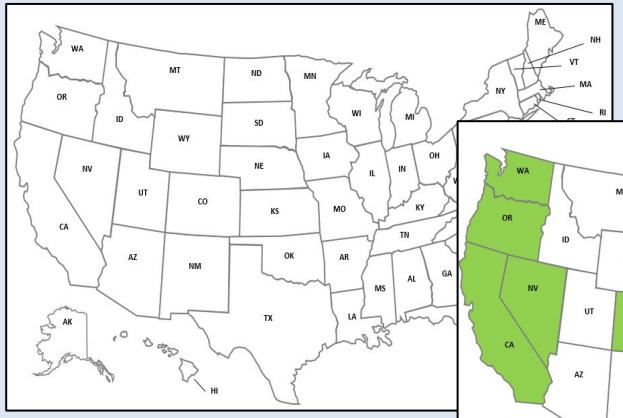
Prescription Stimulants
(e.g. Adderall, Ritalin)
Mainly Schedule II

Prescription Sedatives and Tranquillizers
(e.g. barbiturates and benzodiazepines)
Mainly Schedule II and III

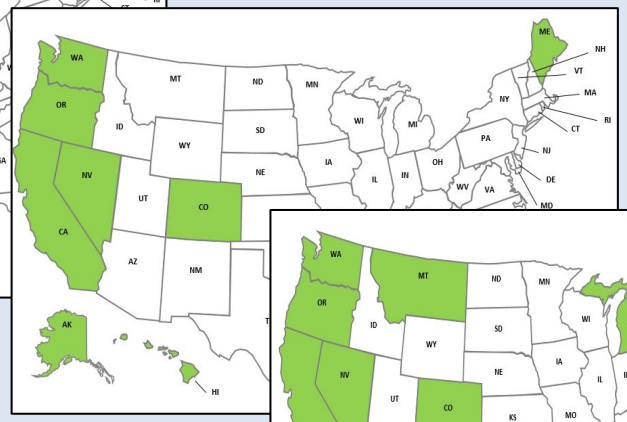
Prescription Painkillers
(e.g. morphine, oxycodone, codeine, codeine + ibuprofen)
Mainly Schedule II and III

http://www.deadiversion.usdoj.gov/21cfr/21usc/812.htm

Changes in state legalization of medical and recreational cannabis use



1991-1992



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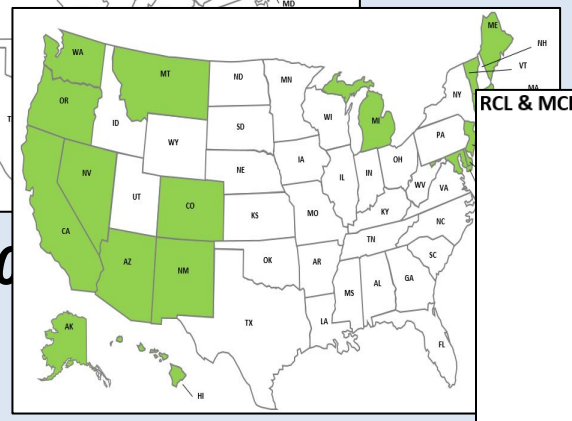
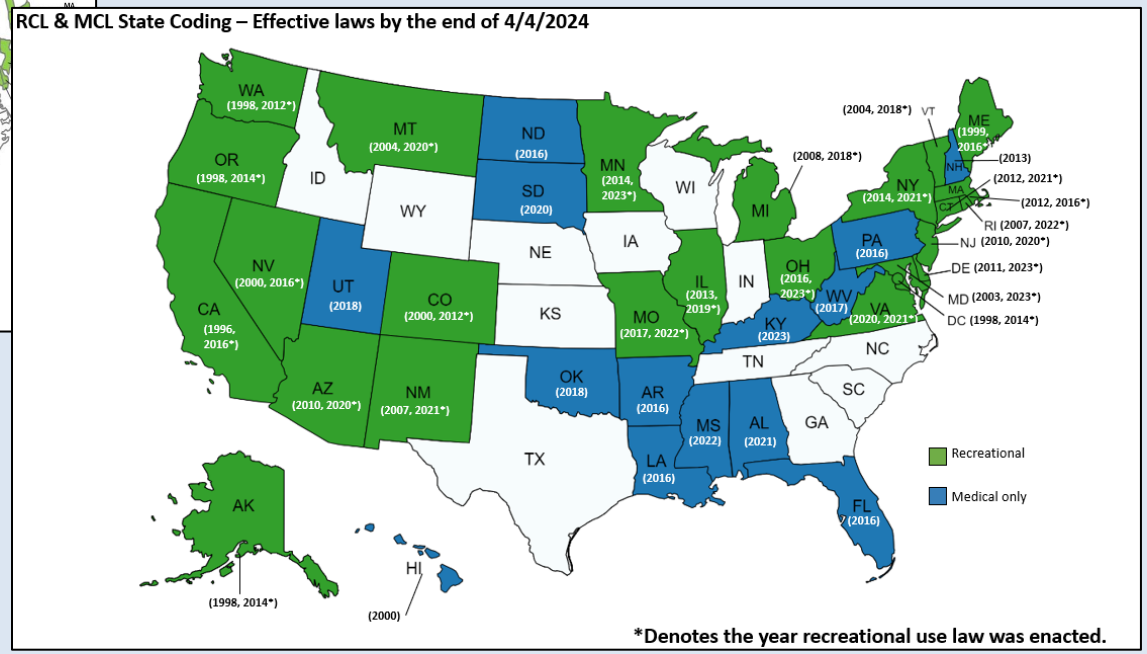
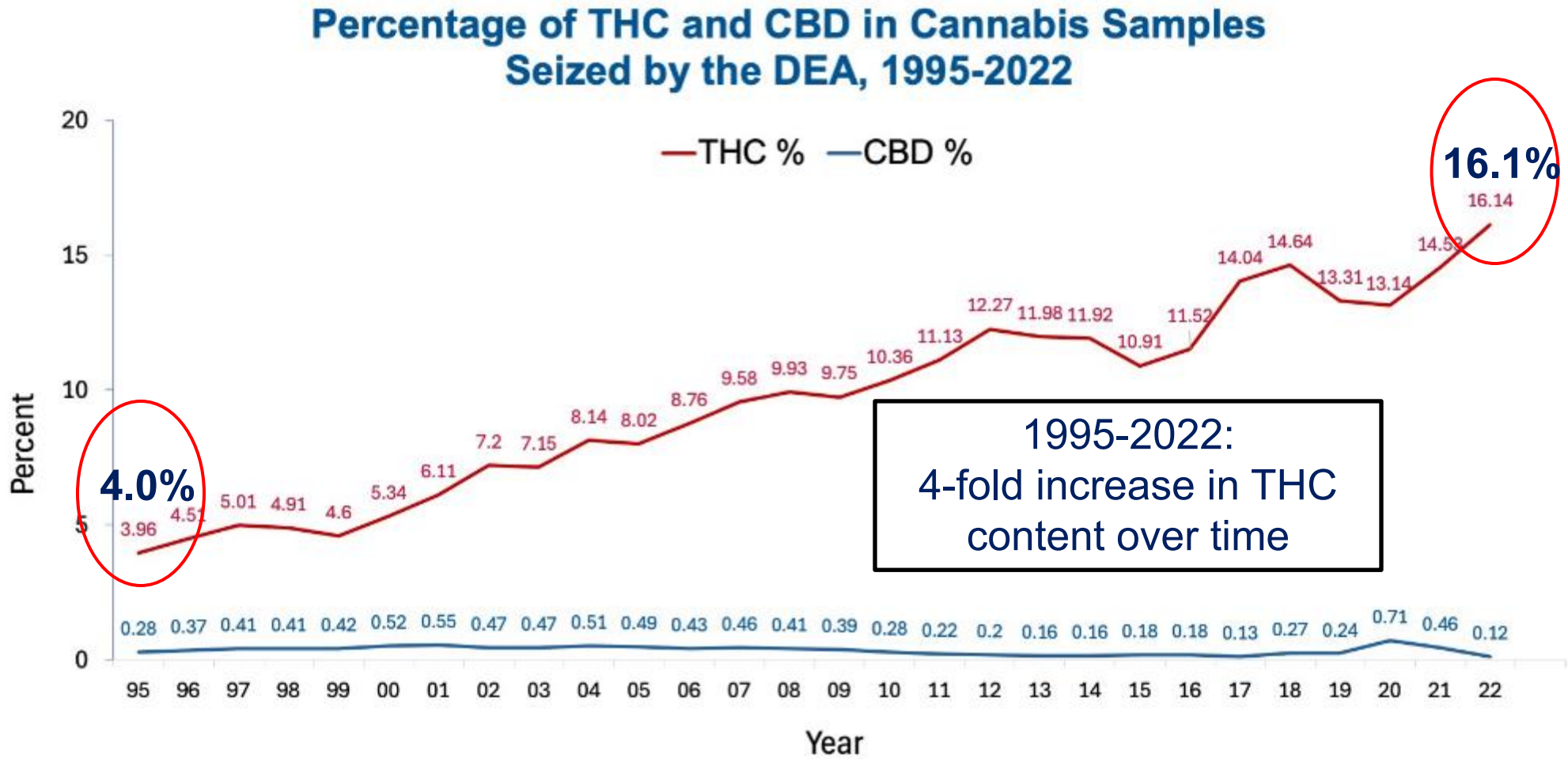


2012-2013



2024

Increases in Δ-THC^9 concentration of illicit cannabis



SOURCE: U Miss, Potency Monitoring Project

Change in Types of products and routes of administration: Now much stronger than in earlier years

Product/route of administration	Potency
Flower (smoking)	15-20%
Concentrates (vaped)	40-80%
Dabbing concentrates	50-80%



Cannabis: an increasingly commercialized product

- Growing profit-oriented cannabis industry
- Increases in potency to “give customers what they want”
- Cannabis often promoted as having medical benefits
- Some claims of benefit are evidence-based, while others not

Cannabis:
Potential benefits and risks

Potential benefits

- Pleasurable subjective effects, enjoyment
- Treatment of medical conditions, e.g., pain, insomnia, nausea in cancer patients, epilepsy

Potential harms

- Hyperemesis syndrome
- Poor birth outcomes
- Risk of vehicle crash
- Poor adherence to psychiatric medications
- Poor perioperative outcomes
- Psychosocial & psychiatric problems
- Cannabis Use Disorder (CUD)

Diagnosing substance use disorders (SUD): DSM-IV, DSM-5 criteria

- DSM-IV criteria published in 1994
- DSM-5 criteria published in 2013
- SUD criteria largely overlapped but structure was different
- DSM-5-TR (Text Revision) published in 2022
- DSM-5-TR updated text but did not change diagnostic criteria

Substance Use Disorder Criteria: DSM-IV

Diagnostic Criteria	Abuse	Dependence
Failure to fulfill major role obligations	X	--
Hazardous use	X	--
Substance-related legal problems	X	--
Social/interpersonal substance-related problems	X	--
Tolerance	--	X
Withdrawal	--	X
Persistent desire/unsuccessful efforts to cut down	--	X
Using more or over for longer than was intended	--	X
Neglect of important activities	--	X
Great deal of time spent in substance activities	--	X
Psychological/Physical use-related problems	--	X
Diagnostic Threshold	**1+ criteria**	**3+ criteria**

1+

3+

American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision. Washington, DC, American Psychiatric Association, 2000.

Mechanisms of Psychiatric Illness

DSM-5 Criteria for Substance Use Disorders: Recommendations and Rationale

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Marc Schuckit, M.D.

Bridget F. Grant, Ph.D.

Since DSM-IV was published in 1994, its approach to substance use disorders has come under scrutiny. Strengths were identified (notably, reliability and validity of dependence), but concerns have also arisen. The DSM-5 Substance-Related Disorders Work Group considered these issues and recommended revisions for DSM-5. General concerns included whether to retain the division into two main disorders (dependence and abuse), whether substance use disorder criteria should be added or removed, and whether an appropriate substance use disorder severity indicator could be identified. Specific issues included possible addition of withdrawal syndromes for several substances, alignment of nicotine criteria with those for other substances, addition of biomarkers, and inclusion of nonsubstance, behavioral addictions.

This article presents the major issues and evidence considered by the work group, which included literature reviews and extensive new data analyses. The work group recommendations for DSM-5 revisions included combining abuse and dependence criteria into a single substance use disorder based on consistent findings from over 200,000 study participants, dropping legal problems and adding craving as criteria, adding cannabis and caffeine withdrawal syndromes, aligning tobacco use disorder criteria with other substance use disorders, and moving gambling disorders to the chapter formerly reserved for substance-related disorders. The proposed changes overcome many problems, while further studies will be needed to address issues for which less data were available.

(Am J Psychiatry 2013; 170:834–851)

Cannabis Use Disorder Criteria: DSM-IV and DSM-5

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

11 criteria

Cannabis Dependence: ICD-11

A pattern of recurrent episodic or continuous use of cannabis with evidence of impaired regulation of cannabis use manifested by **2 or more** of the following:

- Impaired control over use: (i.e., onset, frequency, intensity, duration, termination, context);
- Increasing precedence of cannabis use over other aspects of life: cannabis use continues or escalates despite harm or negative consequences (e.g., negative impact on relationships, work, school, or health);
- Physiological features: 1) tolerance; 2) withdrawal symptoms following cessation or reduction in use, or 3) repeated use of cannabis or similar substances to prevent or alleviate withdrawal symptoms.
- Duration: ≥12 months or ≥ 3 months if use is daily or almost daily

Risk of Cannabis Use Disorder Among Individuals Who Use Cannabis

Addictive Behaviors 109 (2020) 106479

Contents lists available at ScienceDirect

Addictive Behaviors

journal homepage: www.elsevier.com/locate/addictbeh

What is the prevalence and risk of cannabis use disorders among people who use cannabis? a systematic review and *meta*-analysis

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[b] Centre for Youth Substance Abuse Research, The University of Queensland, Australia

HIGHLIGHTS

- There is a global shift towards cannabis legalization and underestimation of harms.
- A systematic review *meta*-analysed the risk of cannabis use disorders (CUD) from use.
- People who use cannabis have a 1 in 5 risk of developing a CUD.
- Risks increase if cannabis is initiated early and used frequently.
- The public needs to be informed about the risks of developing CUD from cannabis use.

Frequency of use and risk for CUD 3-17 years later: 6 compiled studies, n=40,984

Baseline cannabis use frequency	Relative Risk (RR) of follow-up 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

Robinson T et al., Drug Alch Depend, 2022

Cannabis use and Cannabis use disorder (CUD): Demographic and psychiatric correlates/risk factors

DSM-5 Cannabis Use Disorder: Associated Sociodemographic Characteristics NESARC-III (2012-2013), N = 36,309

Characteristic	Adjusted Odd Ratios 12-month DSM-5 Cannabis Use Disorder			
	Any	Mild	Moderate	Severe
Sex				
Male	**2.2**	**2.2**	**1.8**	**2.8**
Female	- -	- -	- -	- -
Race/Ethnicity				
Black	**1.4**	1.1	**1.7**	**2.0**
Native American	**2.1**	1.7	1.7	**3.6**
Asian/Pacific Islander	**0.4**	**0.2**	0.6	0.8
Hispanic	**0.7**	**0.5**	0.8	1.1
White	- -	- -	- -	- -
Age (years)				
18-29	**7.2**	**6.5**	**7.1**	**9.7**
30-44	**3.6**	**3.5**	**3.0**	**4.8**
≥45	- -	- -	- -	- -

Hasin et al., Am J Psychiatry 2016

DSM-5 Cannabis Use Disorder: Associated with Other SUDs NESARC-III (2012-2013), N = 36,309

Comorbid DSM-5 Disorder	Adjusted Odds ratios 12-month DSM-5 Cannabis Use Disorder			
	Any	Mild	Moderate	Severe
Any other SUD	9.3	7.4	12.2	13.1
Alcohol use disorder	6.0	5.1	7.7	6.8
Other drug use disorder	9.0	6.6	11.5	13.4
Nicotine use disorder	6.2	4.8	7.3	10.5

Hasin et al., Am J Psychiatry 2016

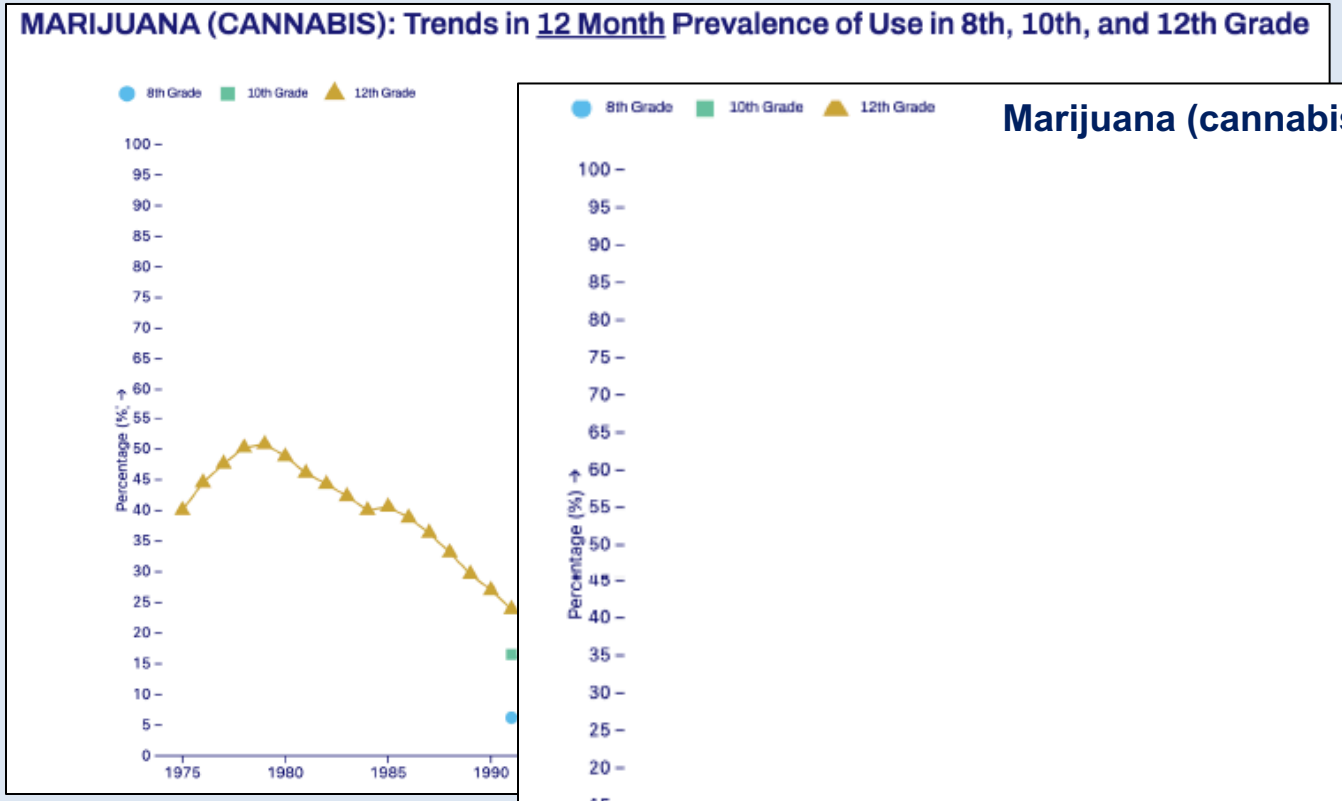
DSM-5 Cannabis Use Disorder: Associated with psychiatric disorders NESARC-III (2012-2013), N = 36,309

Comorbid Disorder	Adjusted Odds Ratios 12-month DSM-5 Cannabis Use Disorder			
	Any	Mild	Moderate	Severe
Any mood disorder	3.8	2.8	3.5	8.1
Major depressive disorder	2.8	2.2	3.1	4.2
Bipolar I	5.0	3.4	4.1	10.1
Bipolar II	2.7	2.7	3.4	1.9
Any anxiety disorder	2.8	2.2	2.9	4.4
Panic Disorder	3.3	2.5	2.8	6.6
Agoraphobia	2.6	2.4	3.5	2.0
Social phobia	2.3	1.3	3.5	3.9
Specific phobia	1.7	1.4	2.2	1.9
Generalized anxiety	3.7	3.0	3.6	6.3
PTSD	4.3	2.1	6.2	9.5

Hasin et al., Am J Psychiatry 2016

Time Trends of Cannabis Use in Adolescents

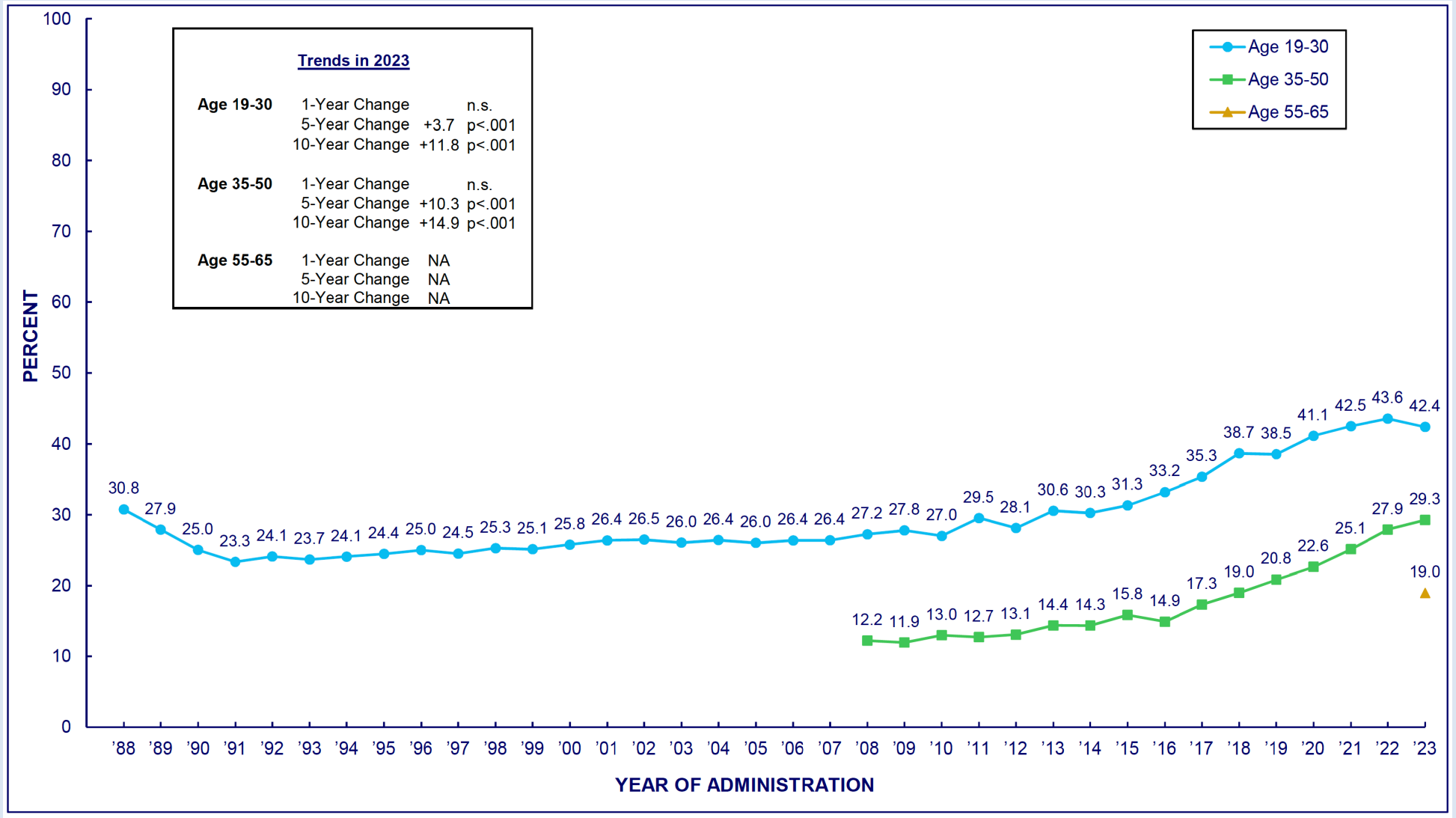
U.S. Adolescent Cannabis Use, Monitoring The Future



https://monitoringthefuture.org/results/annual-reports/

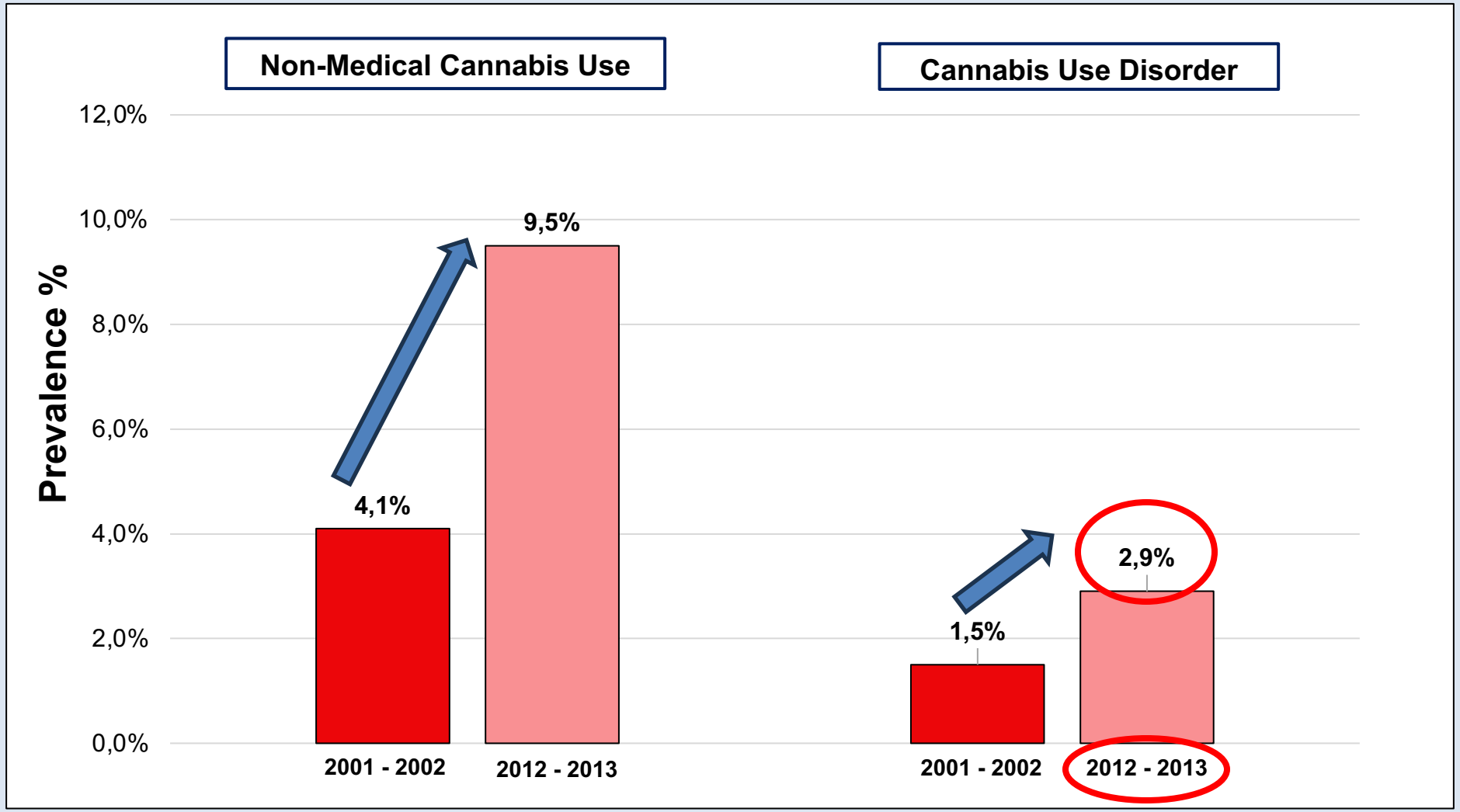
Time trends of cannabis use and CUD in adults

Trends in any adult cannabis use, past 12-months, 1988 - 2023

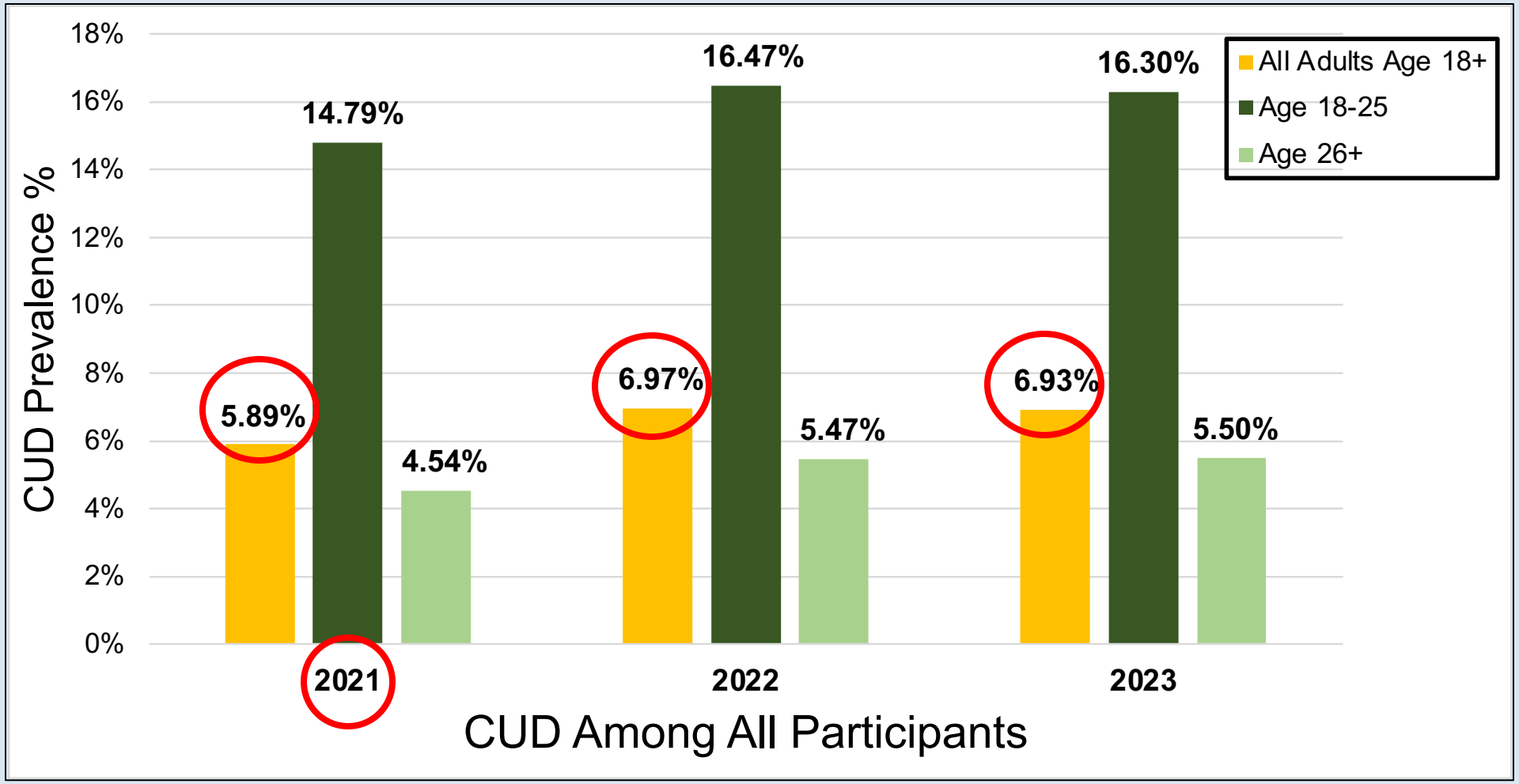


Monitoring The Future: adult panel data

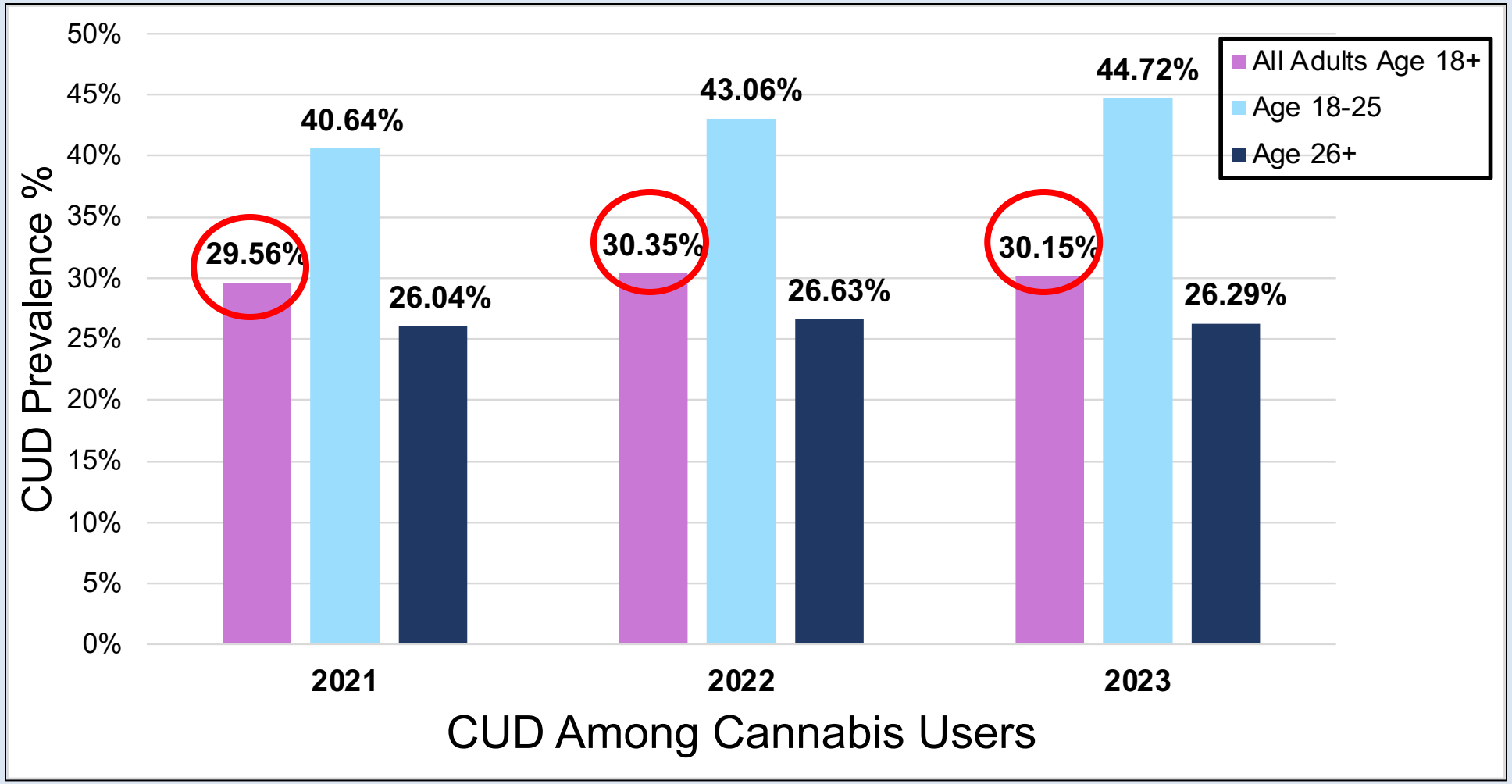
Shifts in Prevalence of Non-Medical Cannabis Use and Cannabis Use Disorder in U.S. adults NESARC 2001-2002; NESARC-III 2012-2013



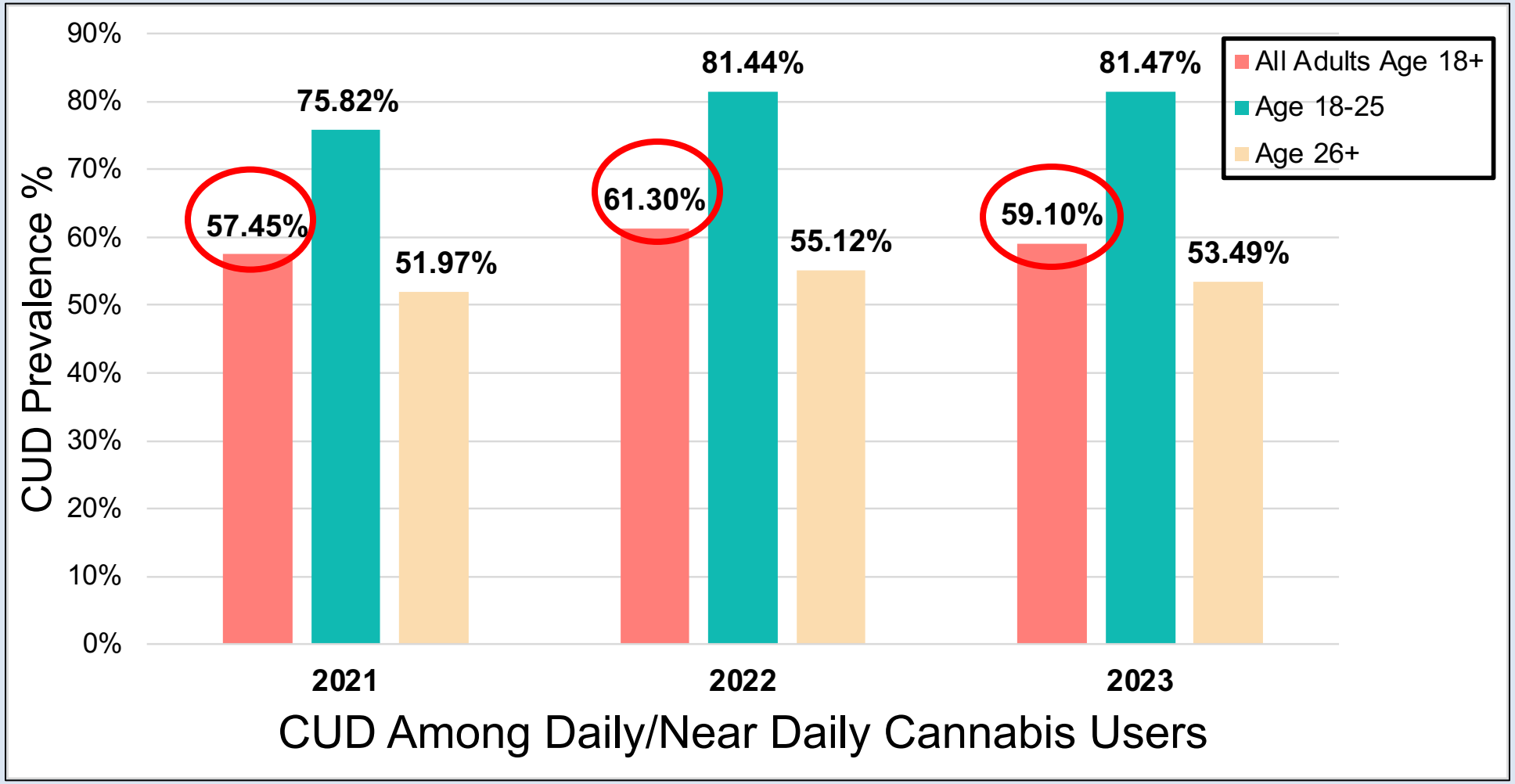
Prevalence of DSM-5 Cannabis Use Disorder
NSDUH, 2021-2023
U.S. adults age 18+



DSM-5 Cannabis Use Disorder, DSM-5 criteria
NSDUH, 2021-2023
U.S. adult cannabis users age 18+



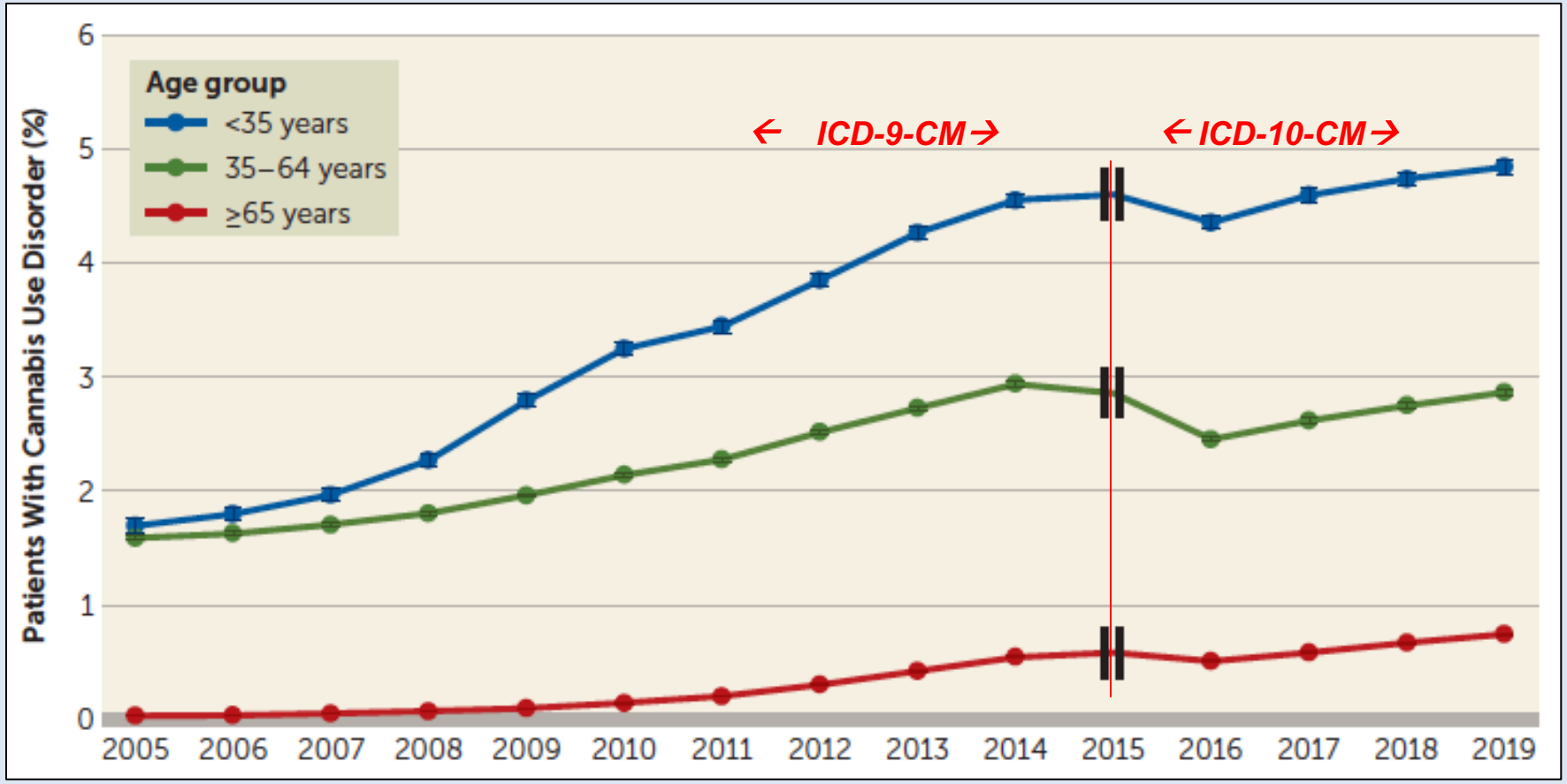
DSM-5 Cannabis Use Disorder, DSM-5 criteria
NSDUH, 2021-2023
U.S. adult daily/near-daily cannabis users age 18+



Veterans Health Administration: Health Data

- Veterans Health Administration (VHA): the largest U.S. integrated healthcare system
- 9 million patients enrolled, primarily veterans of 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 trends in CUD prevalence

Trends in Diagnoses of CUD: Veterans Administration Medical Records, 2005-2019



Overall:
0.85% in 2005
1.92% in 2019

Hasin et al, Am J Psychiatry 2022

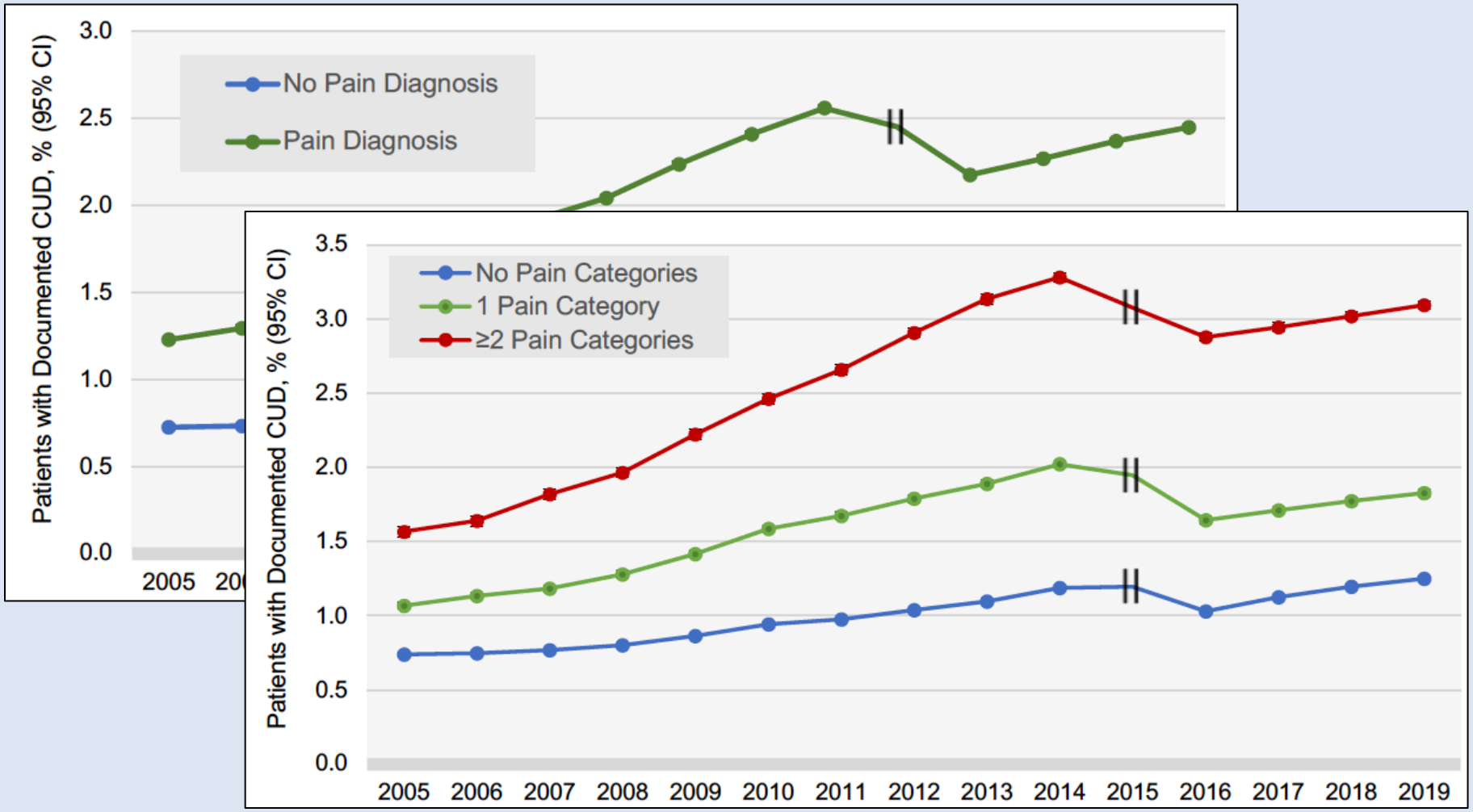
Trends in adult CUD prevalence by clinical comorbidity: pain, psychiatric disorders

Trends by Pain: Using cannabis for pain relief could increase the pool of users and thereby those at risk for CUD.

Trends by Psychiatric Disorders:

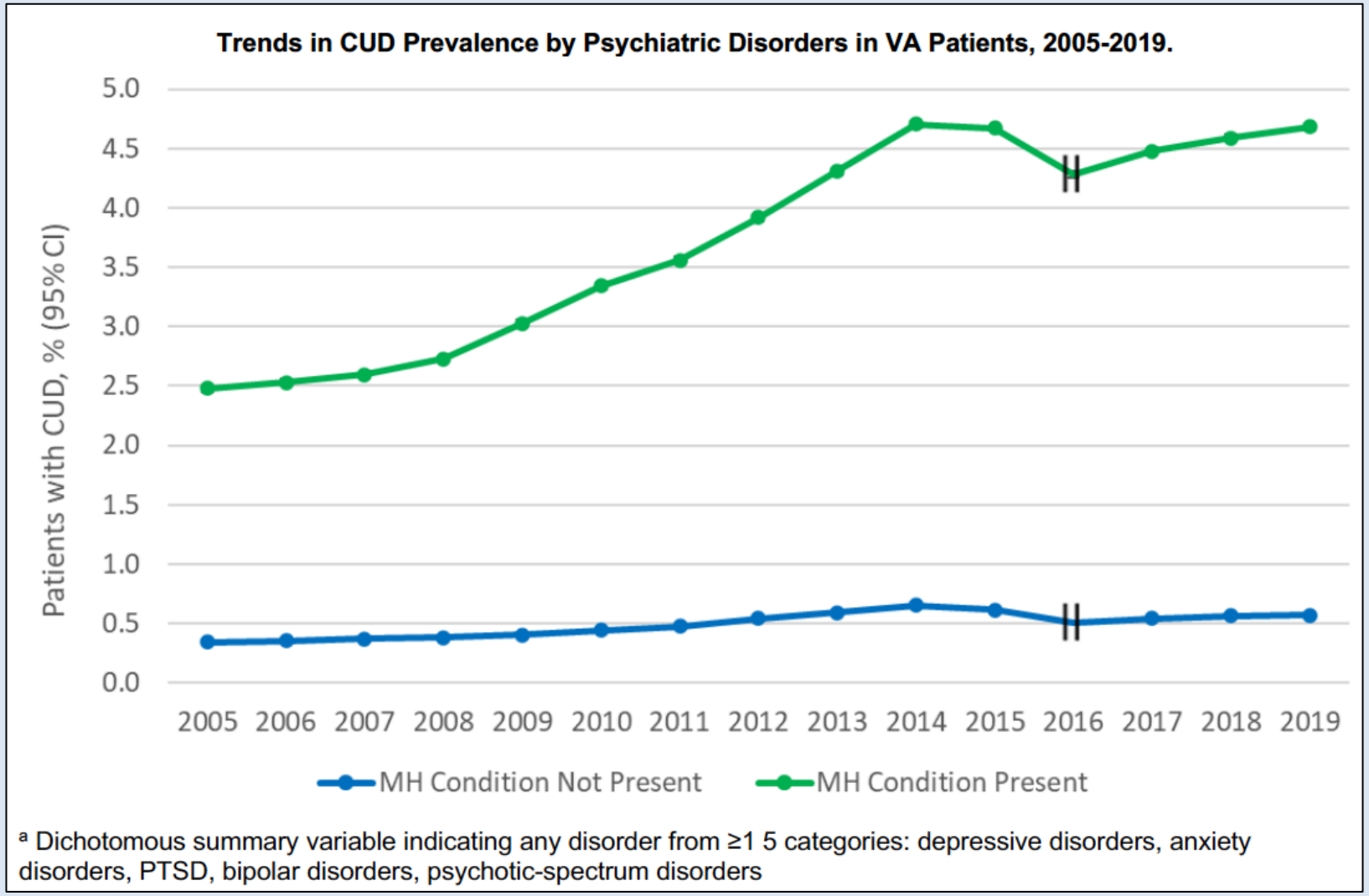
- Using cannabis to relieve psychiatric symptoms could increase the pool of users and thereby those at risk for CUD.
- Use could also cause some psychiatric symptoms/syndromes, e.g., cannabis withdrawal symptoms such as insomnia, depressed mood, and anxiety, increasing use to self-medicate

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



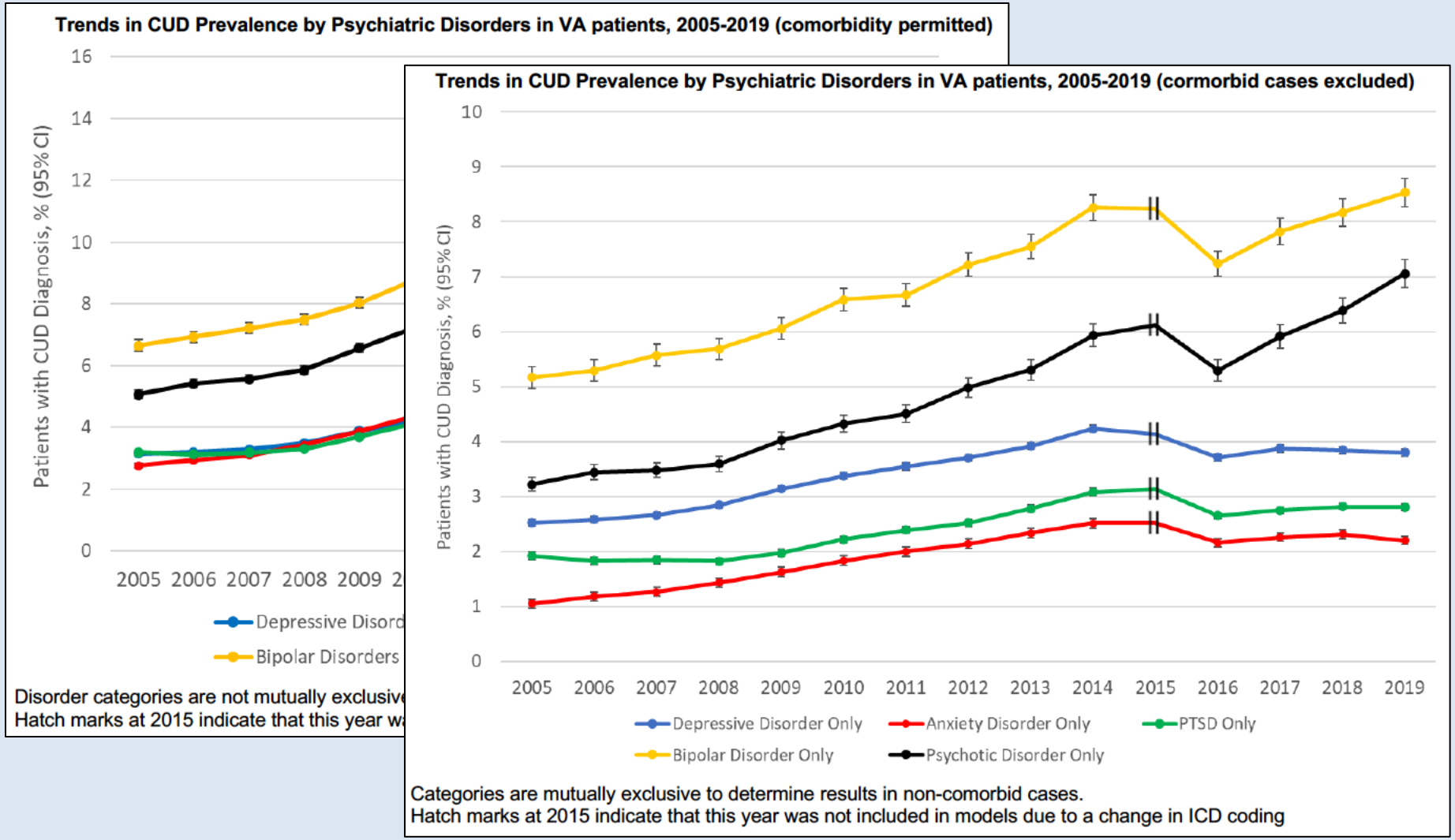
Mannes Z et al., Pain 2023

Trends in CUD diagnoses, VHA patients by any common psychiatric disorder, 2005-2019



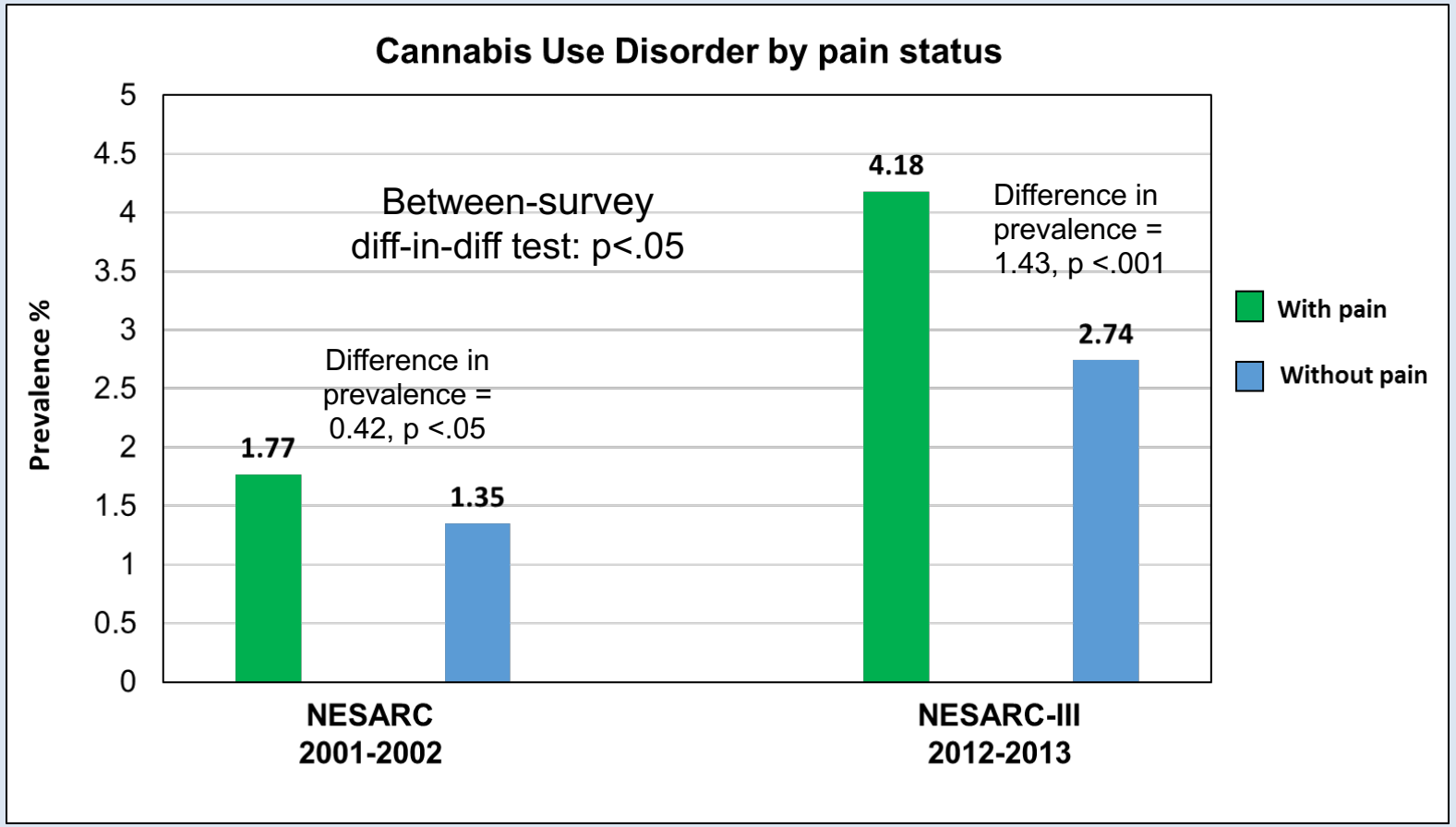
Livne et al., 2024, Am J Psychiatry

Trends in CUD diagnoses, VHA patients by psychiatric disorder, 2005-2019



Livne et al., 2024, Am J Psychiatry

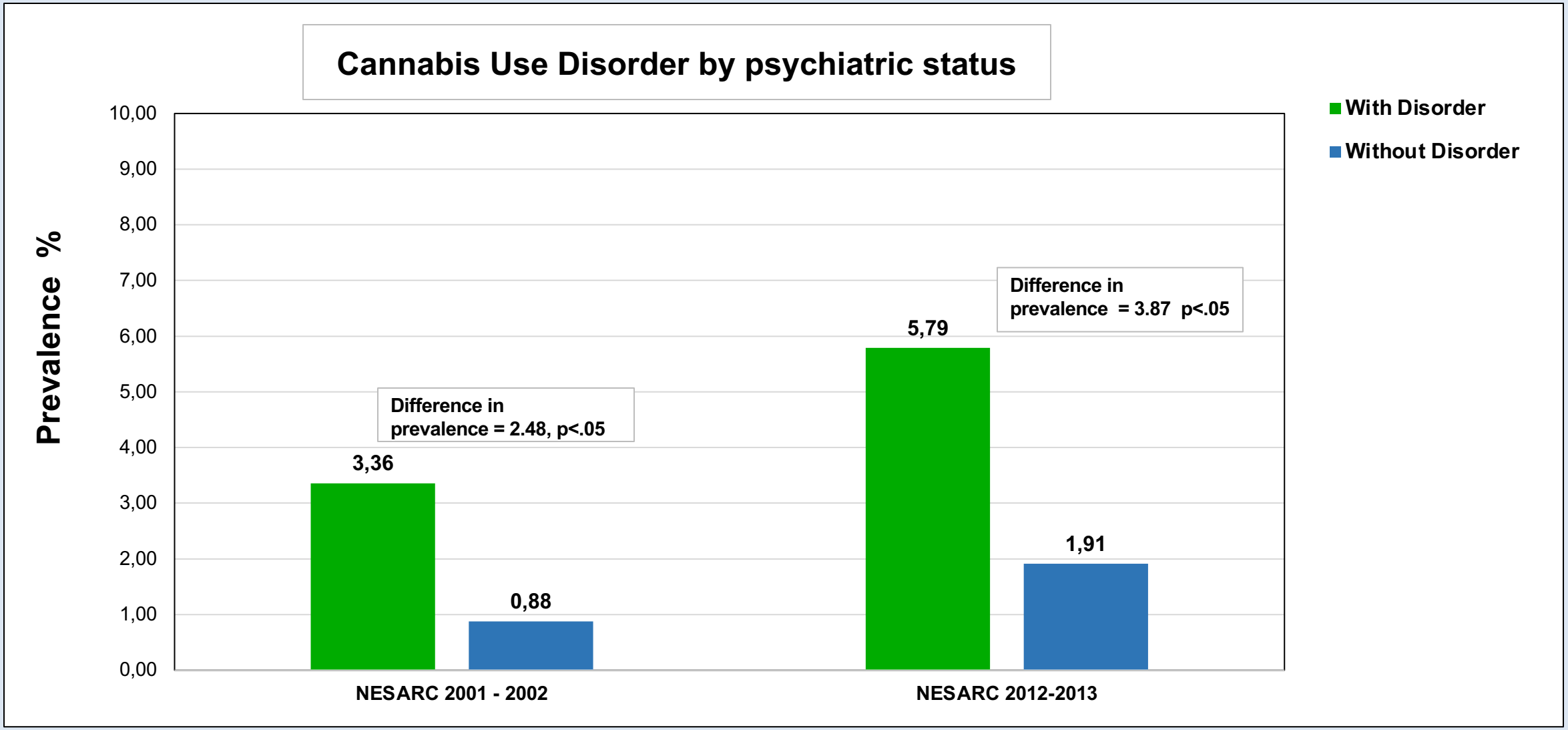
Prevalence (%) of DSM-IV CUD in adults with and without chronic pain NESARC (2001-2002) and NESARC-III (2012-2013)



Differences in CUD prevalence between those with and without pain was greater in 2012-2013 than in 2001-2002

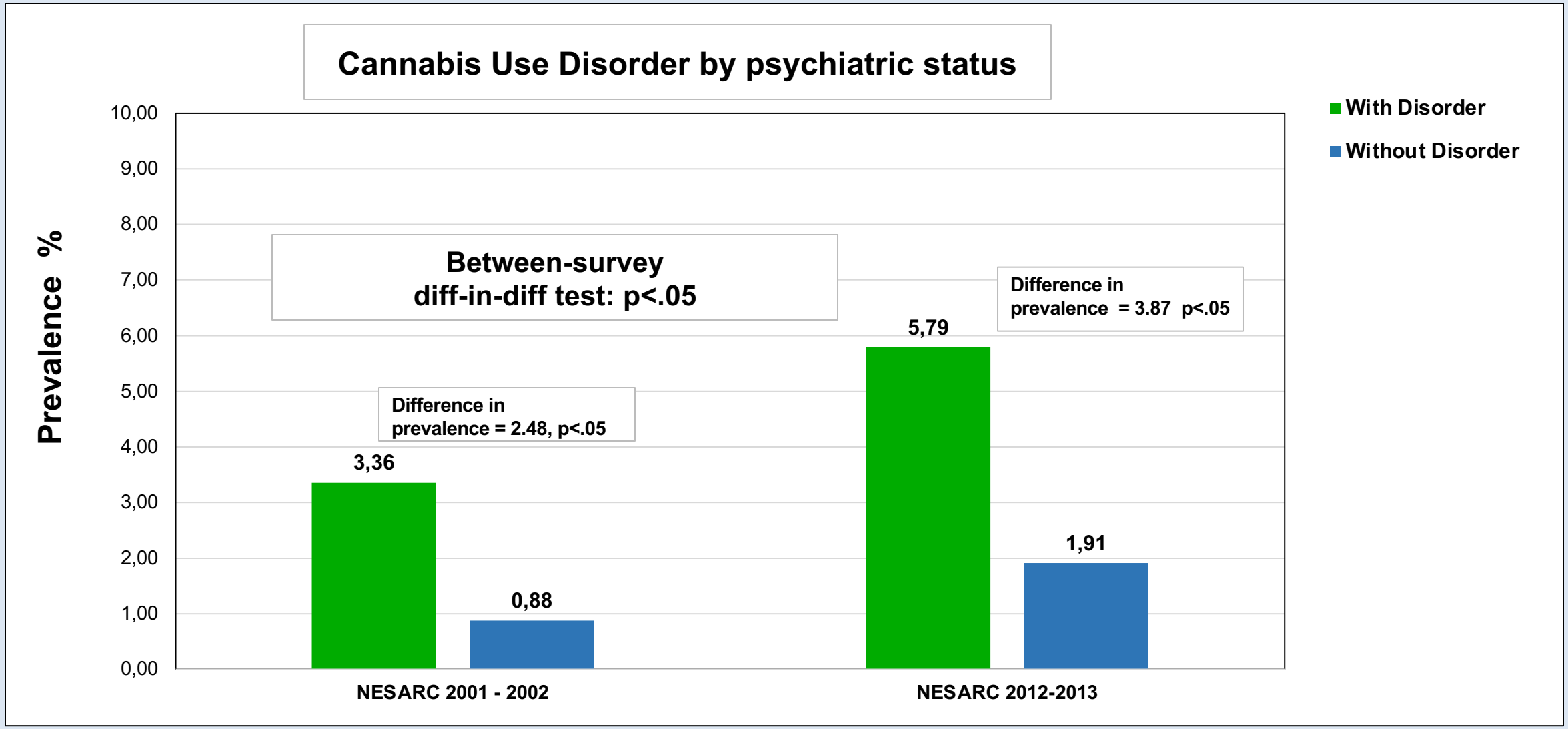
Hasin et al., Am J Psychiatry 2020

DSM-IV CUD in adults with and without Any Psychiatric Disorder NESARC (2001-2002) and NESARC-III (2012-2013)



Hasin et al., Lancet Regional Health – the Americas, in press

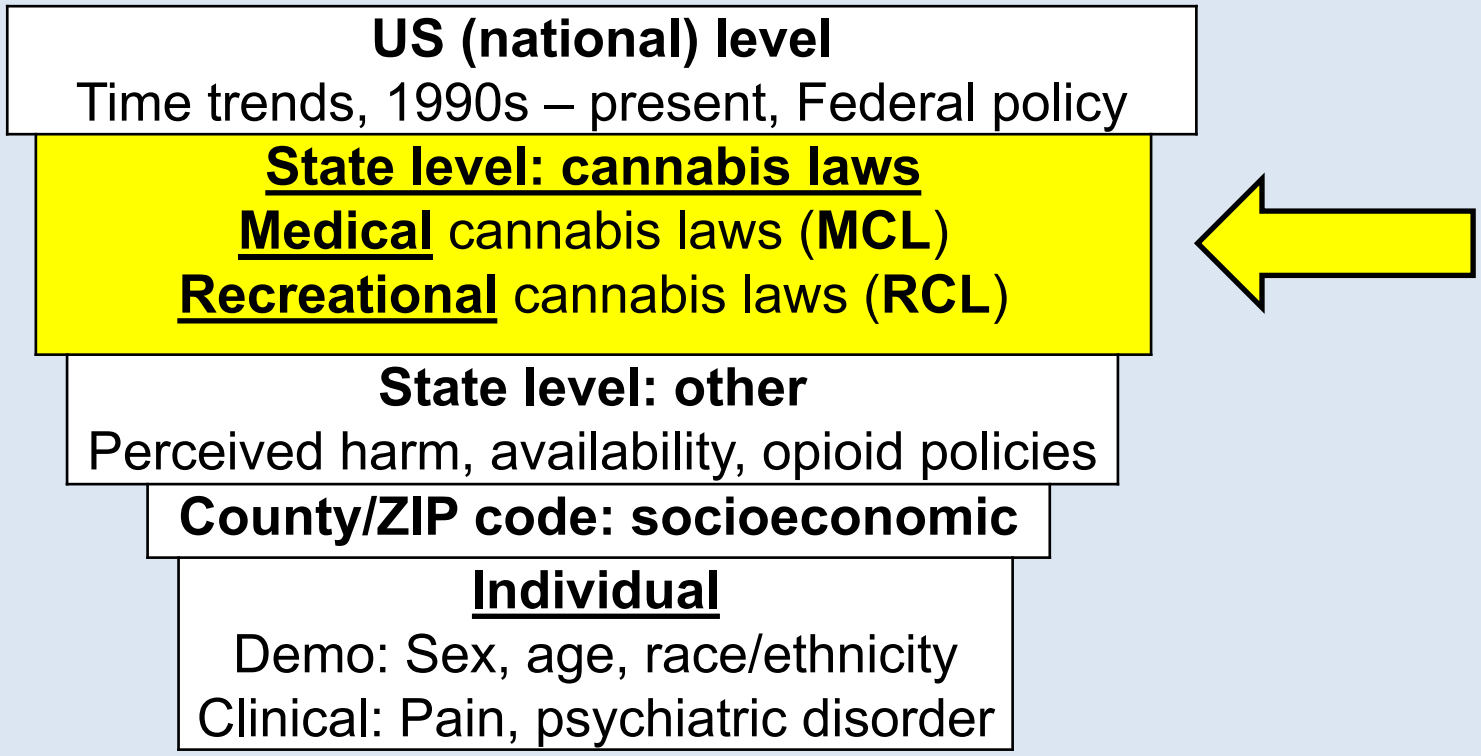
DSM-IV CUD in adults with and without Any Psychiatric Disorder NESARC (2001-2002) and NESARC-III (2012-2013)



Hasin et al., Substance Use & Misuse, 2025

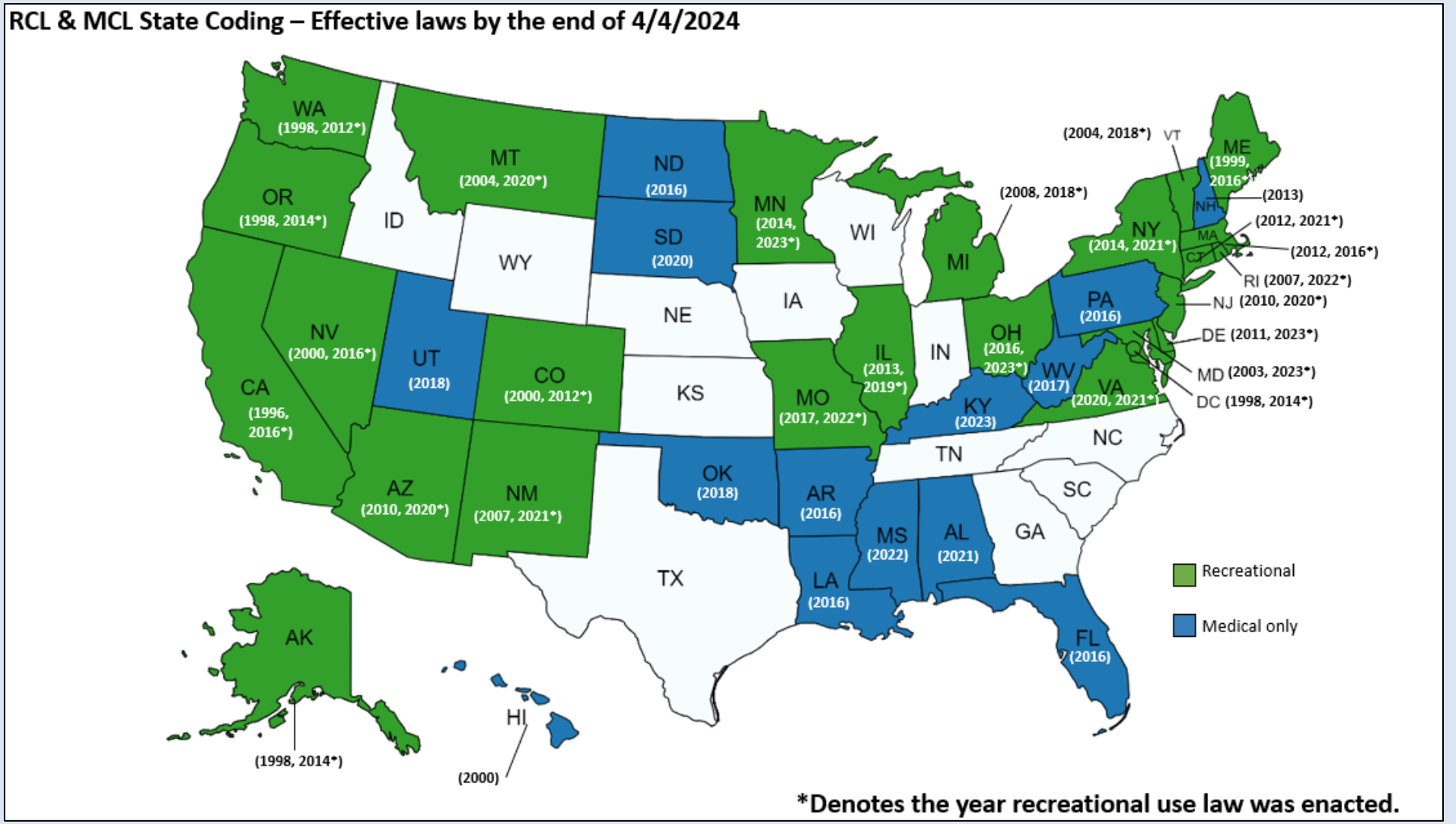
Do state cannabis laws affect rates of cannabis use and CUD?

MULTI-LEVEL FRAMEWORK



Within a socioecological model, MCL and RCL may increase cannabis use and its consequences by increasing marijuana acceptability and availability

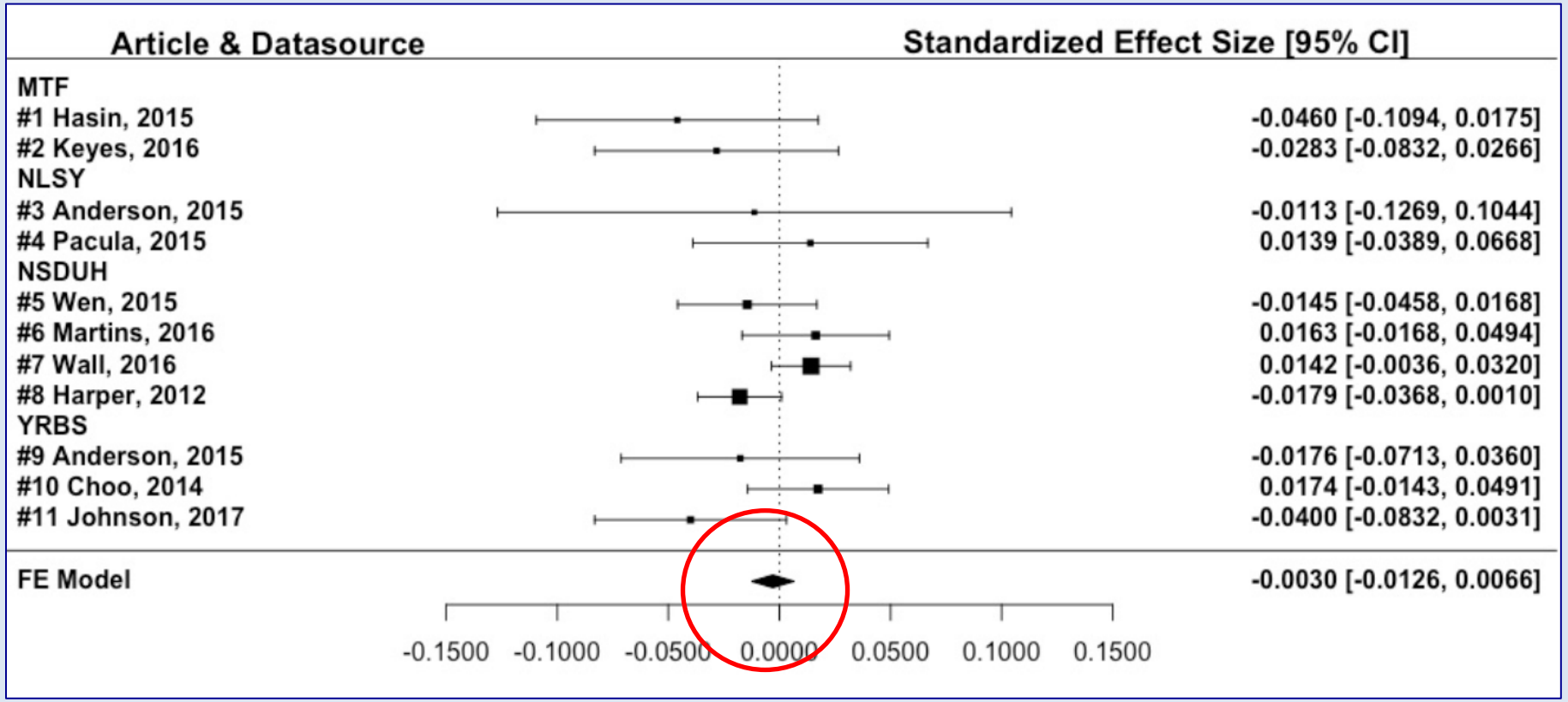
States with medical marijuana laws (ML) and recreational marijuana laws (RML)



Complications to studying the effects of state cannabis laws

- Cannabis laws are not randomly assigned to states
- States enact the laws in different years
- When states enact cannabis laws, they may already have higher rates of cannabis use due to other factors, e.g., sociodemographic characteristics, attitudes
- Study design must address these issues
- Difference-in-difference (diff-in-diff) statistical models often used, with staggered-adoption to account for laws enacted in different years

Medical Cannabis Legalization (MCL) & teen marijuana use: Meta-analysis, 11 studies



No post-passage increases in teen marijuana use after MCL enactment in studies that used appropriate DiD tests

Sarvet et al., Addiction, 2018

Pre- and post-MCL change in past-month non-medical cannabis use, NSDUH, 2004-2013, by age group

Age	Prevalence (%)		aOR	P-value
	MCL states	Non-MCL states		
12 - 17	8.55	8.77	1.03	0.34
18 - 25	19.01	18.59	0.97	0.27
26+	5.87	7.15	1.24	<0.001
26 - 39	8.9	10.2	1.2	<0.001
40 - 64	4.5	6.0	1.4	<0.001
65+	0.3	0.8	2.6	<0.001

Difference in difference estimates, adjusted for time-invariant state heterogeneity and national secular trends, individual and state characteristics
Martins SS et al., Drug Alch Depend 2015

Recreational cannabis laws (RCL): Change in cannabis use & DSM-IV CUD
NSDUH surveys, 2008-2016 (n=495,796)

Age groups	Non-medical cannabis use			Frequent use			DSM-IV Cannabis Use Disorder		
	% Pre RCL	% Post RCL	aOR[a]	% Pre RCL	% Post RCL	aOR[a]	% Pre RCL	% Post RCL	aOR[a]
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***

[a] aOR = odds ratios, compared to non-RCL states, adjusted for individual, state sociodemographics
* p<0.05

Cerdá et al., JAMA Psychiatry 2020

MCL and RCL effects on rates of Cannabis Use Disorder, Veterans Health Administration (VHA) patients, 2005-2019

Data source:

Electronic Medical Record data repository for all VHA care: demographics & diagnostic codes

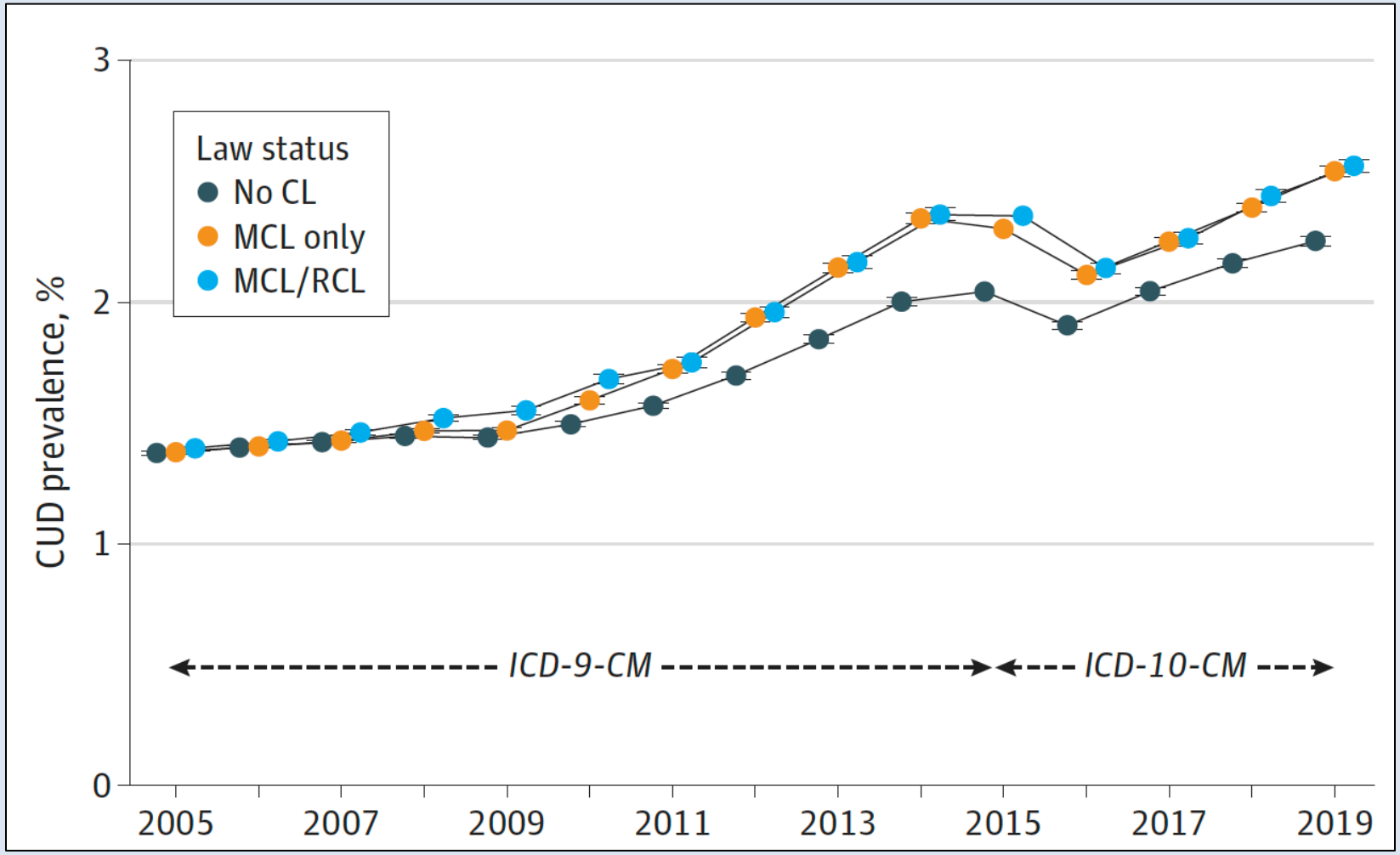
Population:

- Veterans up in US states or Washington DC receiving VHA care, 2005 – 2019 except patients in hospice
- 4.5 – 6 million patients each year

Methods:

- Measures: ICD-9-CM or ICD-10-CM diagnoses made by providers
- DiD analyses by years the states enacted their laws compared to states that did not change their laws since 2005

CUD prevalence (weighted mean estimates), 2005 to 2019,
By state cannabis law status at the end of 2019

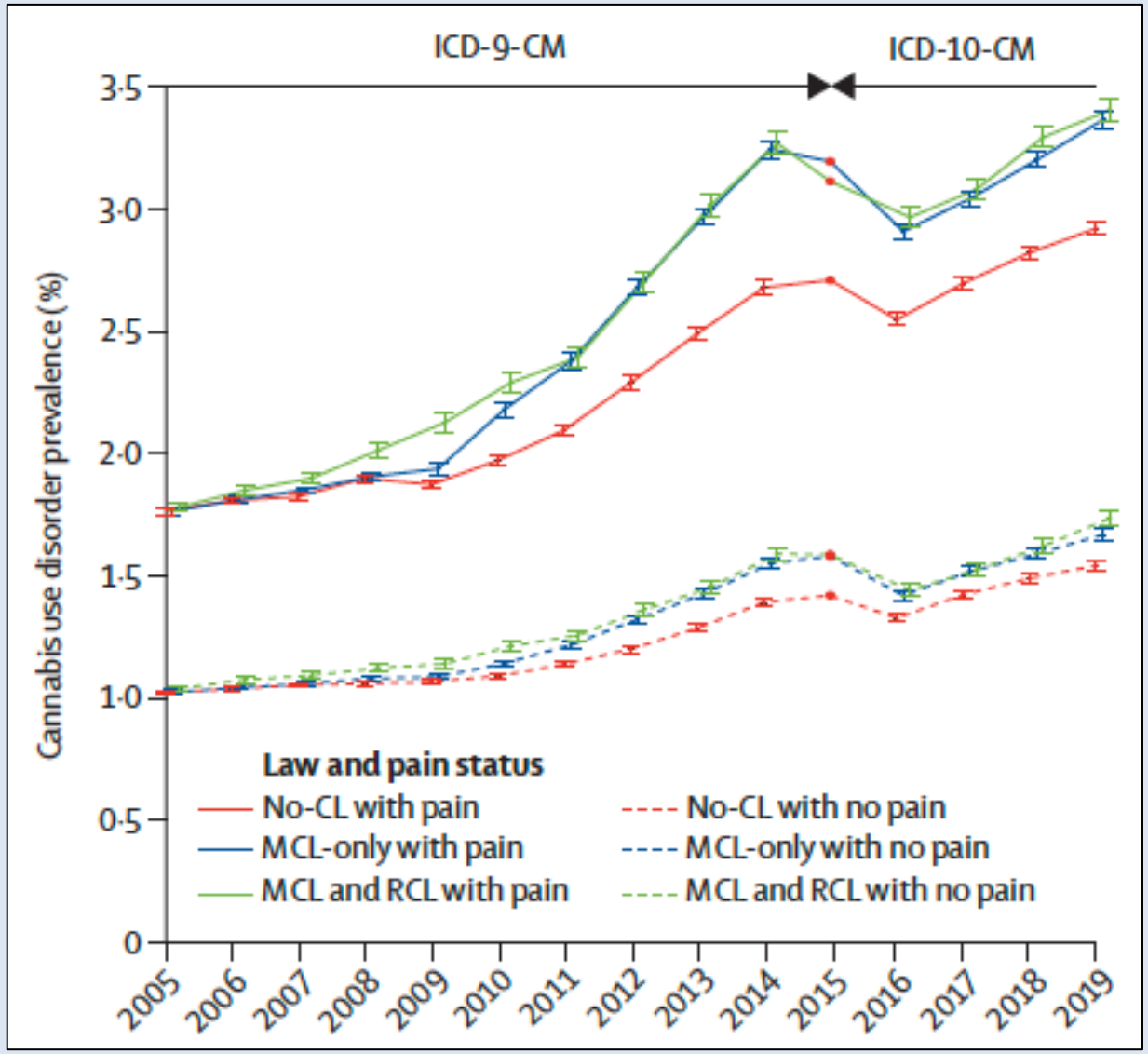


Diff-in-diff tests with staggered-adoption:

Increases greater in states enacting medical or recreational cannabis laws than in other states during contemporaneous years

Hasin et al., JAMA Psychiatry, 2023

CUD prevalence (weighted mean estimates), 2005 to 2019
By pain and by state cannabis law status at the end of 2019



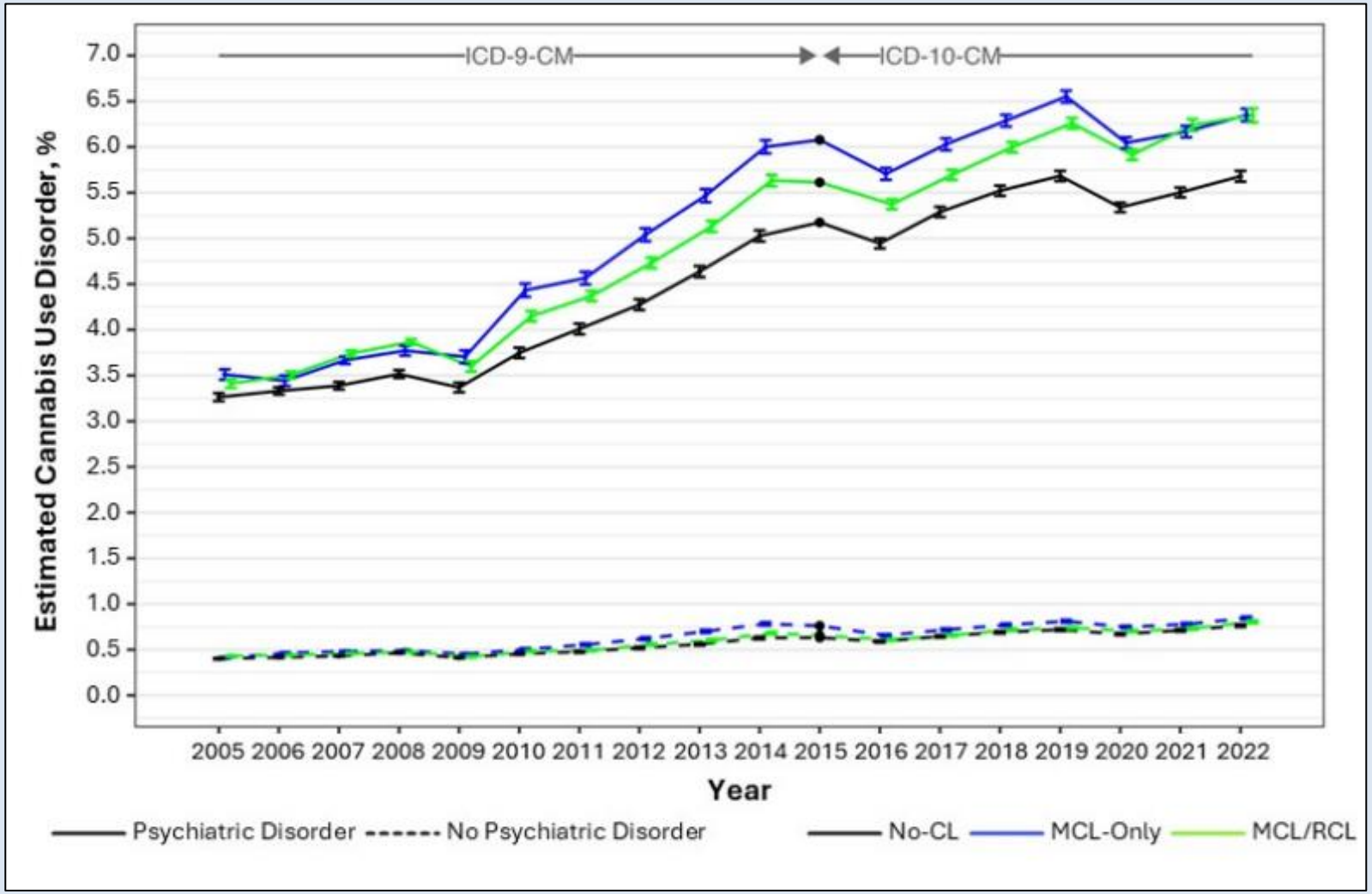
Chronic pain: one or more medical conditions commonly associated with chronic pain

Diff-in-diff tests with staggered-adoption:

State differences due to enacting medical or recreational cannabis laws <u>greater</u> in patients with chronic pain than in other patients

Hasin et al., Lancet Psychiatry, 2023

CUD prevalence (weighted mean estimates), 2005 to 2022 By Any Psychiatric Disorder and by state cannabis law status at the end of 2022



Any Psychiatric Disorder: Depressive, Anxiety, PTSD, Bipolar and Psychotic-Spectrum disorders

Diff-in-diff tests with staggered-adoption:

State differences due to enacting medical or recreational cannabis laws <u>greater</u> in patients with psychiatric disorders than in other patients

Hasin et al., Lancet Regional Health – the Americas, in press

Where are we in the evolving landscape of U.S. adult cannabis use and CUD?

- Prevalences are increasing, especially in groups with known risk factors (pain, psychiatric disorders)
- Perceived risk has reached a very low point
- Commercialization has created misinformation and increasingly potent products
- Potential federal actions on legalization hard to predict

Clinical and policy implications

- Consider screening patients with depression, anxiety or insomnia for patterns of heavy cannabis use
- When patients ask about medical marijuana, provide balanced discussion of potential risks as well as benefits
- In the U.S., support rescheduling of cannabis from DEA Schedule 1 level (risk equivalent to heroin) to a more realistic level that will facilitate research
- Support legislation to create reasonable limits to cannabis potency and availability, and support enforcement of the limits

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