



The Evolving Landscape of Adolescent Cannabis Use

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Disclosures

Neither I nor my spouse/partner has a relevant financial relationship with a commercial interest to disclose.

**Let me skip to the
punchlines...**

**Most teens do not use substances. But many
do.**

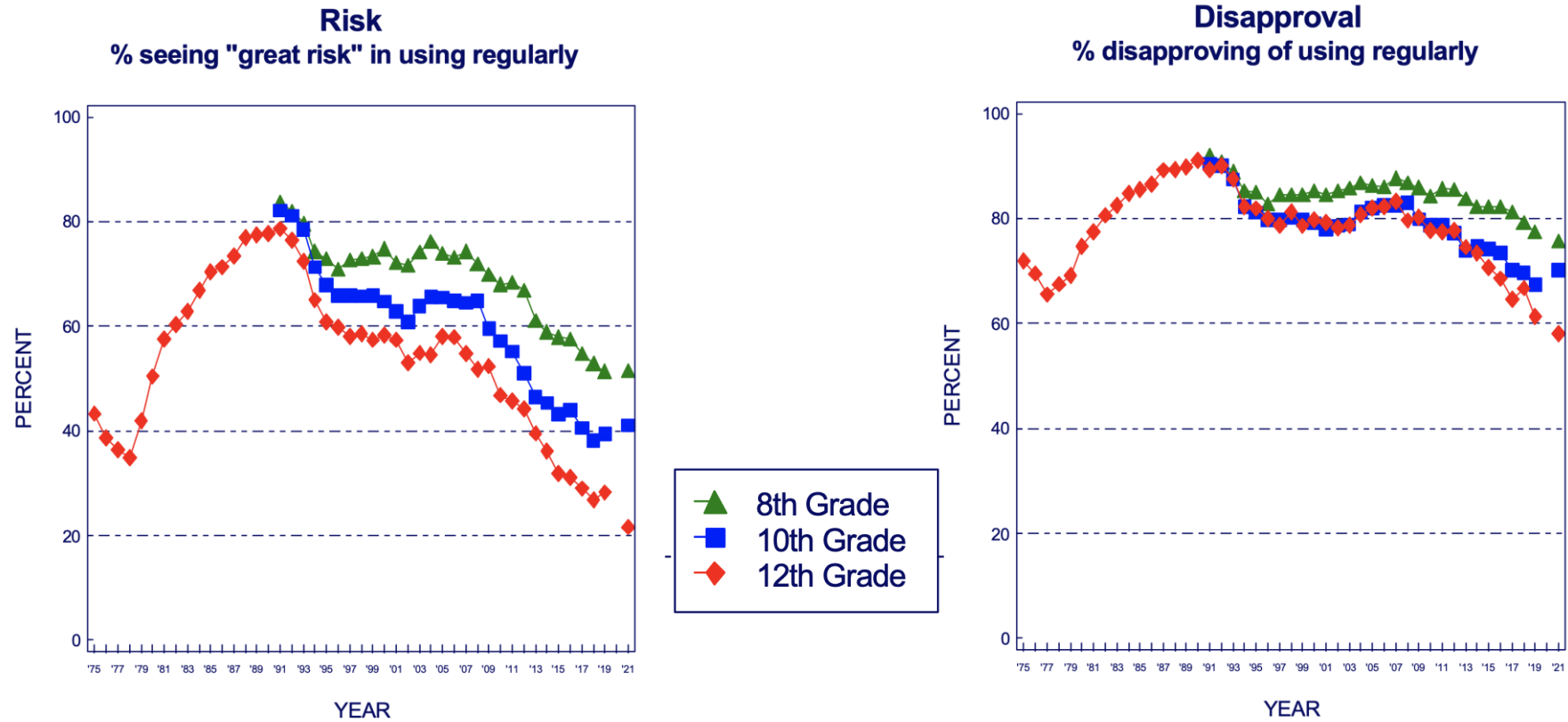
While overall rates of cannabis use have remained stable, the overall landscape of use has done a 180.

There is a lot we don't understand. (And we need to be honest about that.)

There are three things we know....

1. Adolescence is a period of increased risk for substance use initiation. There are subgroups where this risk is even greater.
2. Adolescents are at heightened risk for negative effects.
3. Adolescents who use (any) substances are more likely to experience other mental health concerns.
4. Schools are well poised to represent the prevention arm of our mental health system.

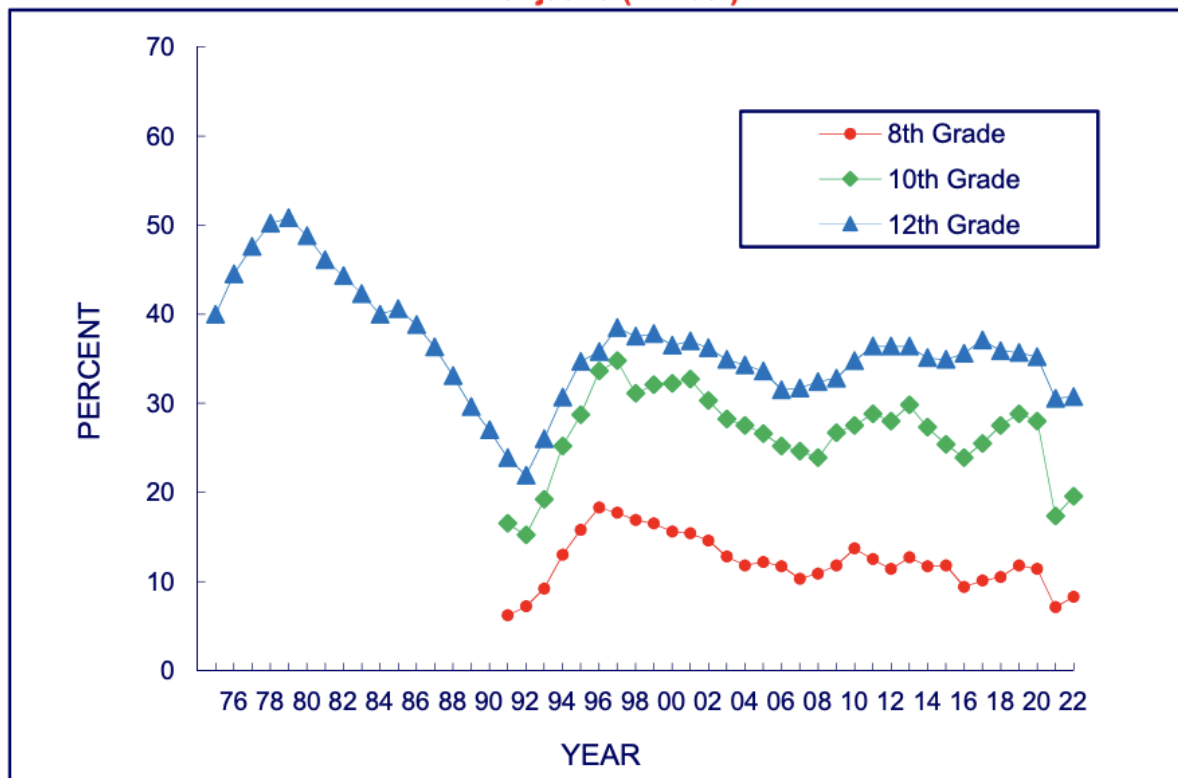
CHANGES IN PERCEPTIONS OF HARM



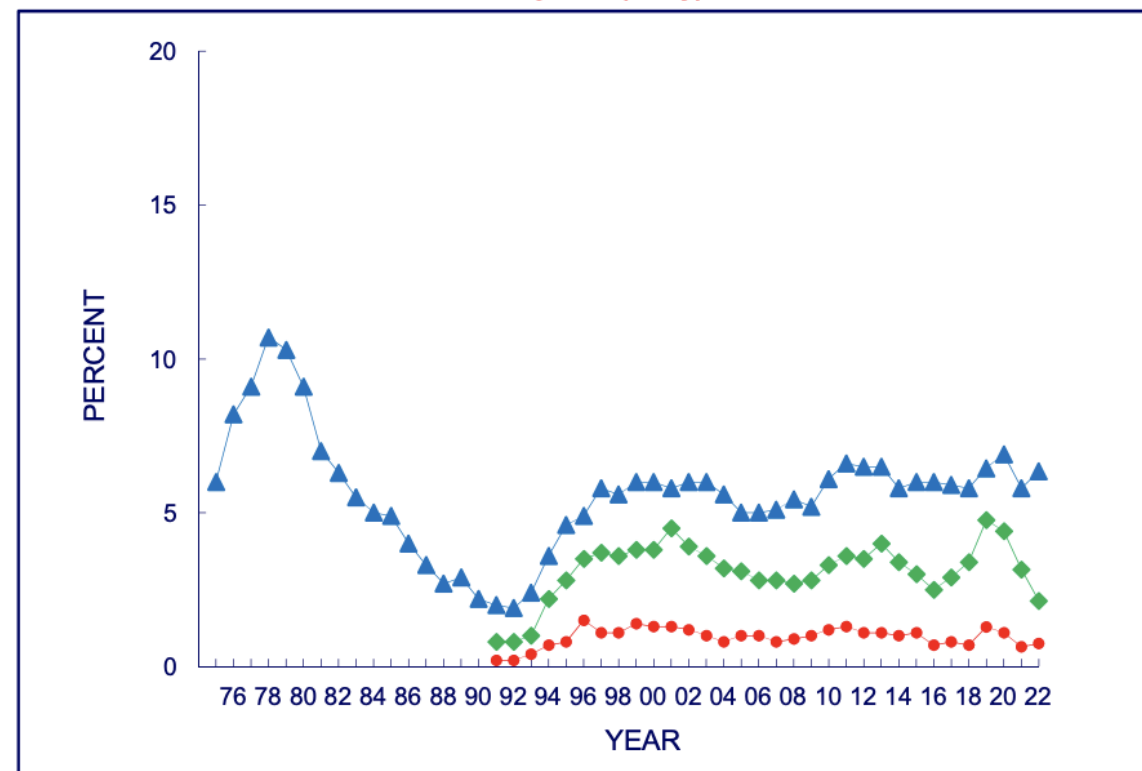
Source. The Monitoring the Future study, the University of Michigan.

TRENDS IN ANNUAL AND PAST 30D PREVALENCE OF USE

Marijuana (Annual)



Marijuana (Daily)



Source. The Monitoring the Future study, the University of Michigan.

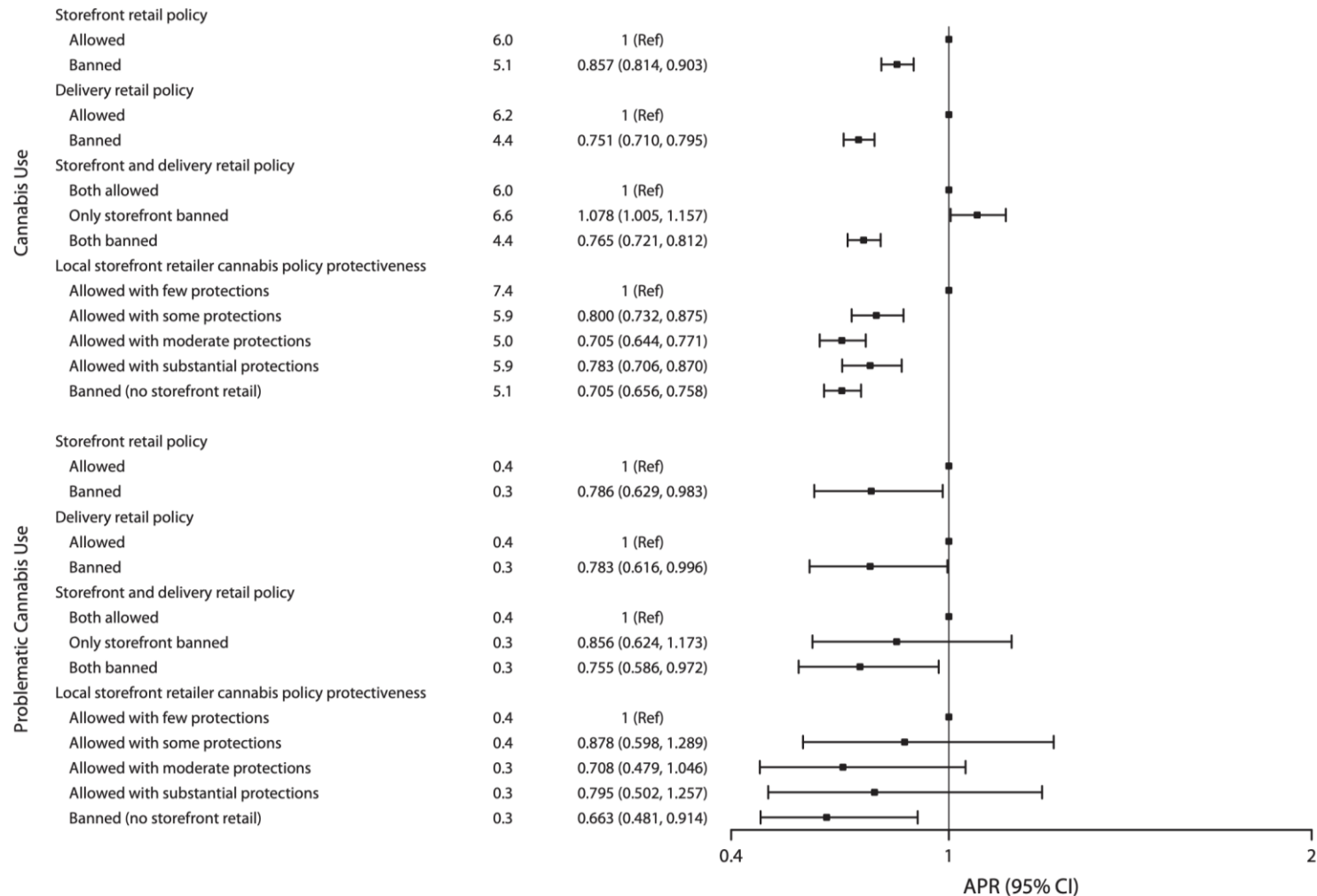


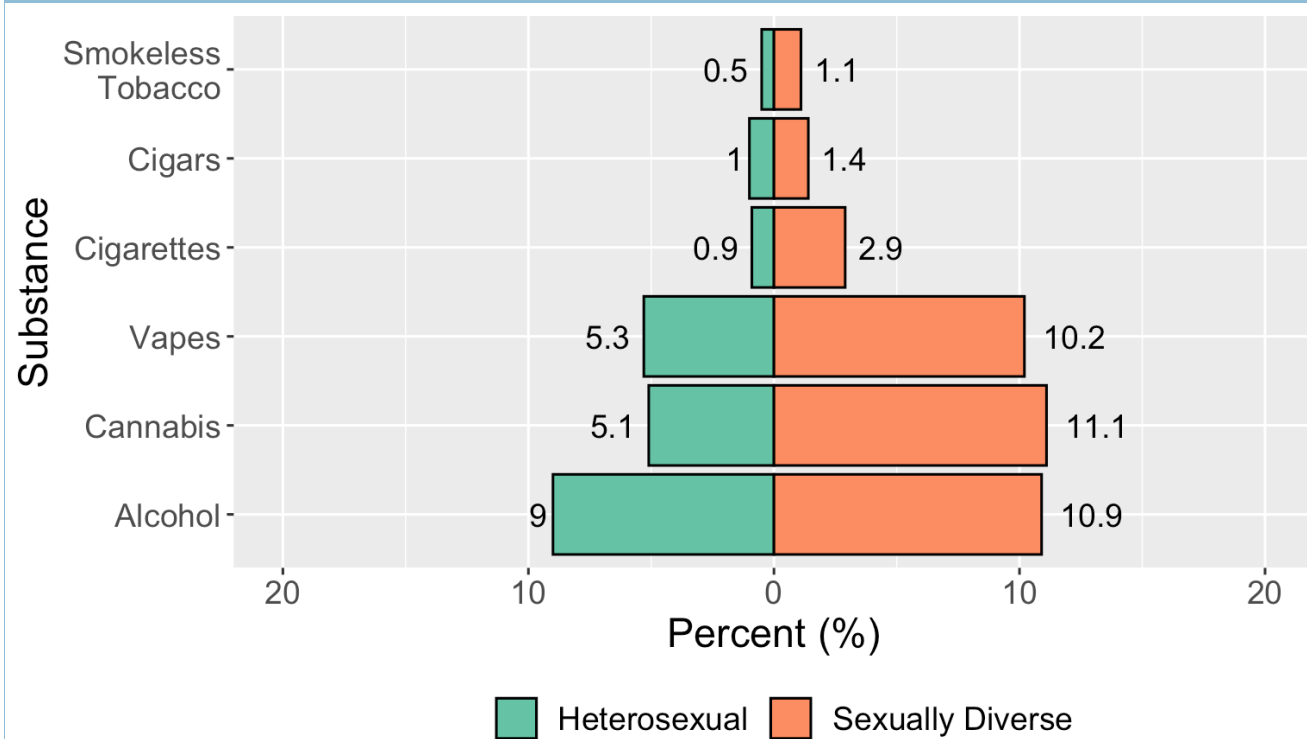
FIGURE 1— Association Between Local Cannabis Policies and Past-Year Cannabis Use and Problematic Cannabis Use Among Adolescents Aged 13–17 Years Screened in 2021: Kaiser Permanente Northern California

Note. APR = adjusted prevalence ratio; CI = confidence interval. The x-axis is on the logarithmic scale.

DIFFERENCES BY LOCAL ACCESS

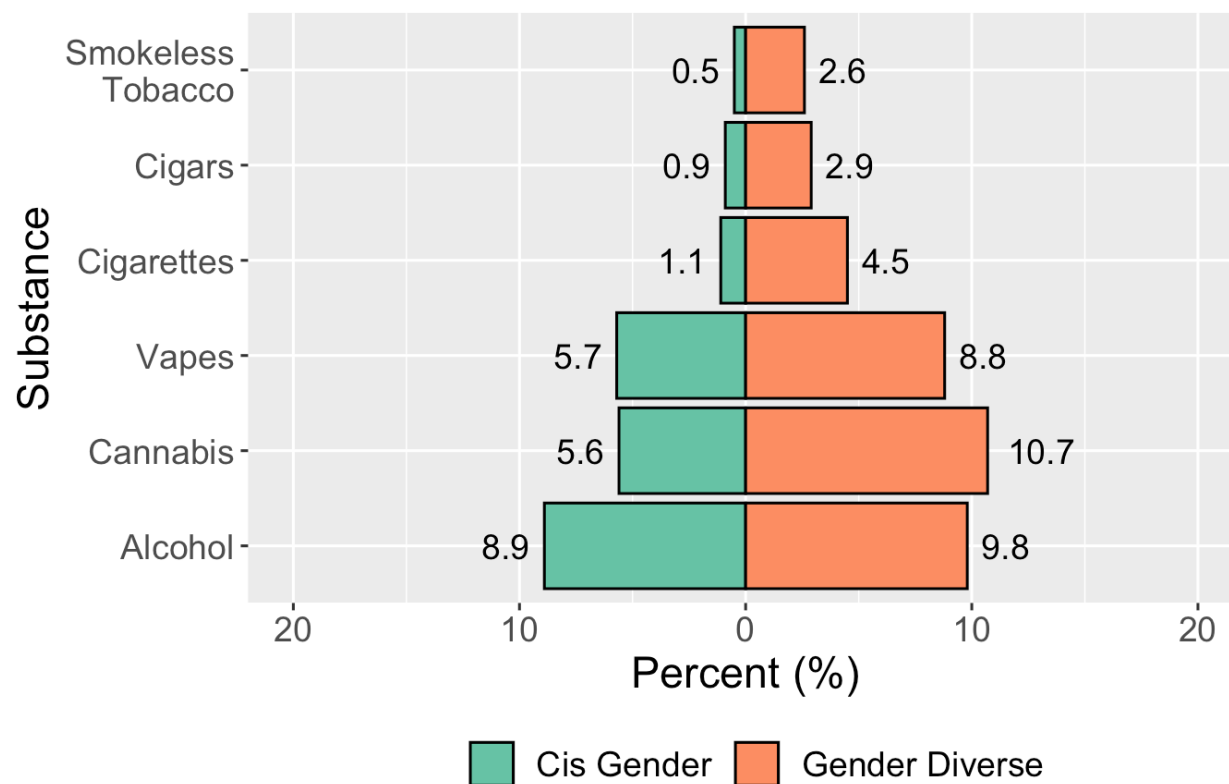


Past 30-Day Substance Use by Sexual Orientation



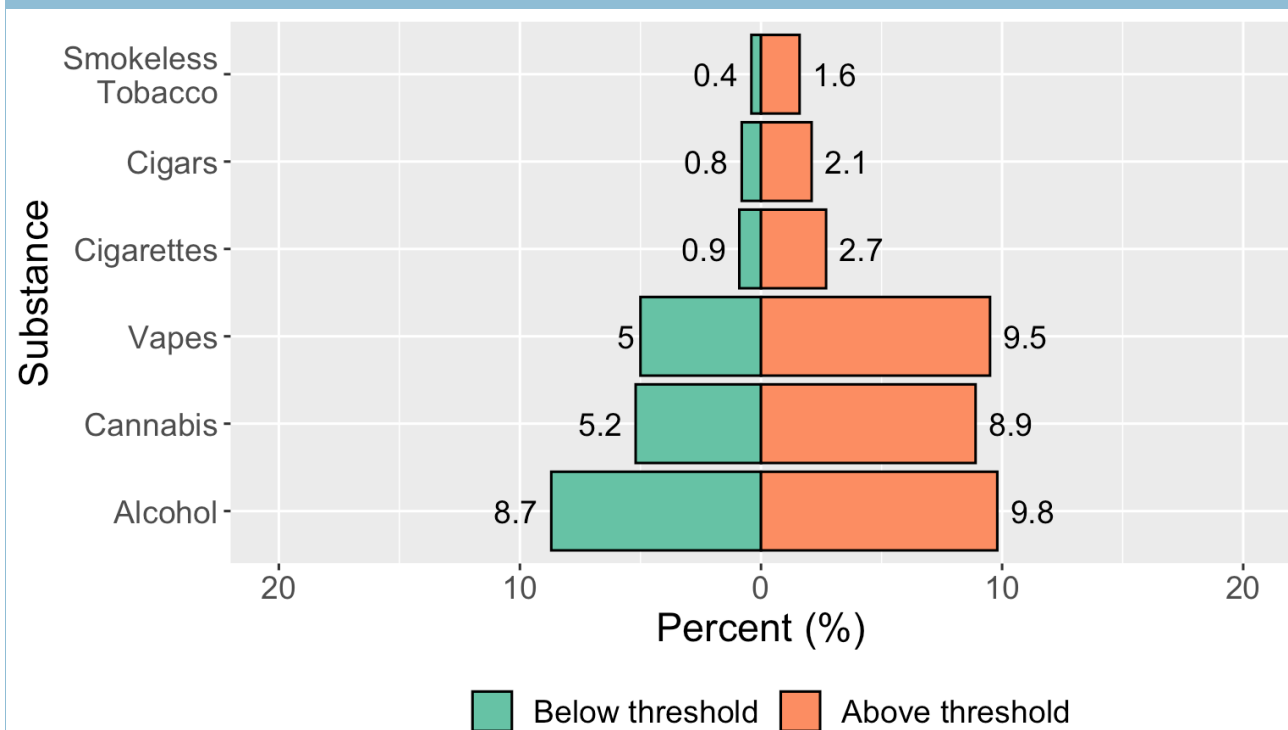
DISPARITIES
IN USE

Past 30-Day Substance Use Gender



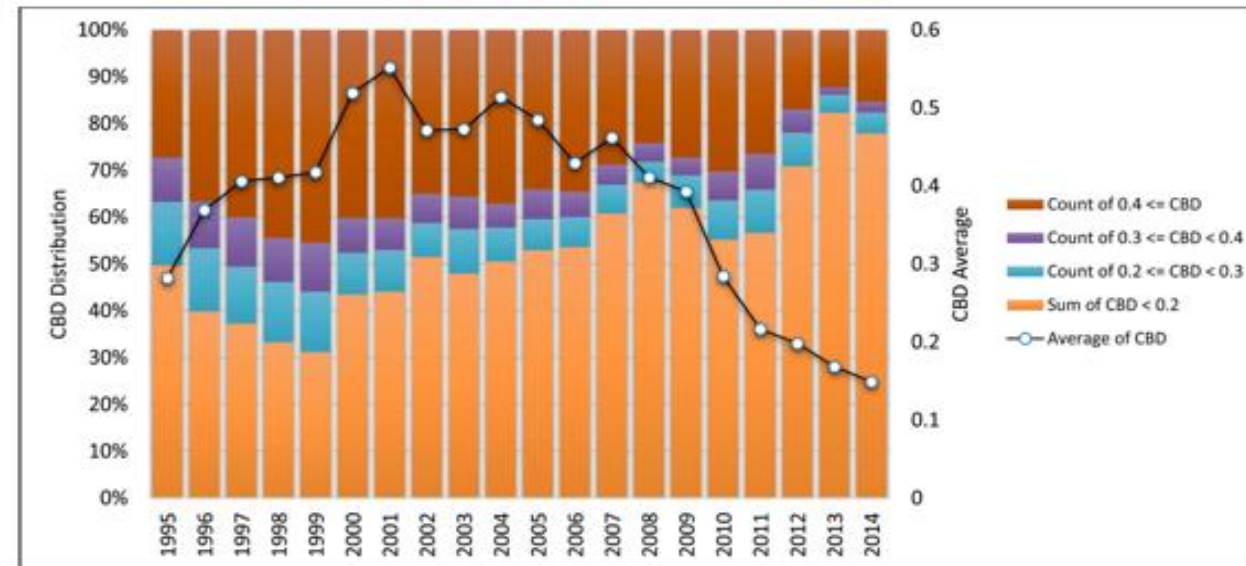
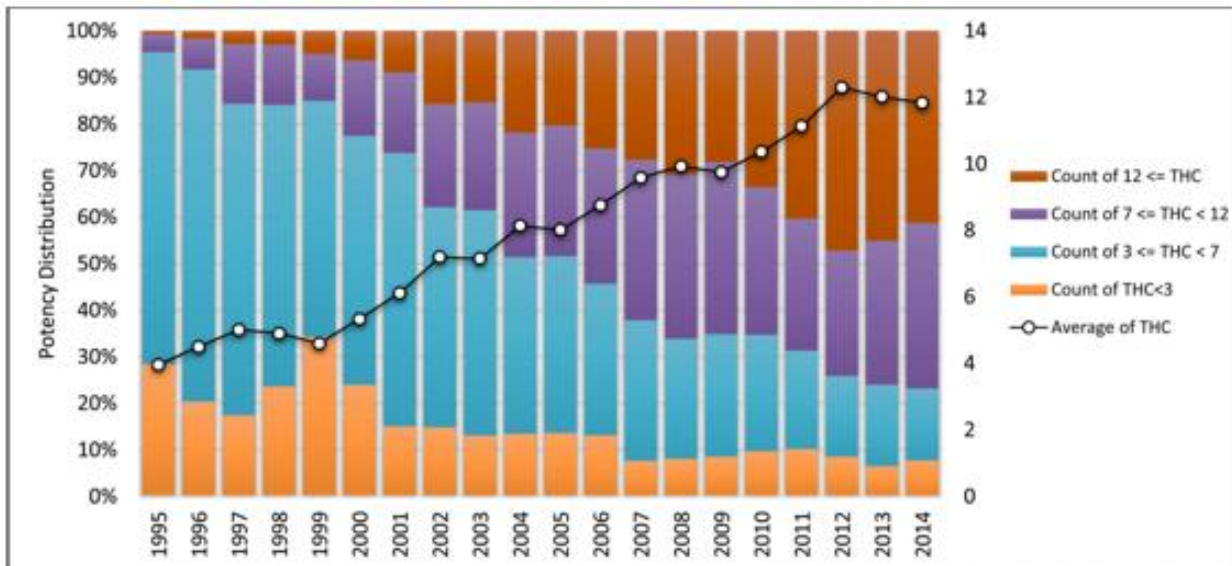
DISPARITIES
IN USE

Past 30-Day Substance Use by APSS Criteria



DISPARITIES
IN USE

RISING POTENCIES





Novel forms of THC delivery are the new norm, yet use is difficult to detect and we have very little information on long-term effects.



Other vape devices

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SMILE

LOGAN
COMMUNICATIONS

THIS IS HAPPENING AGAINST A SOCIETAL BACKDROP THAT IS
INCREASINGLY PERMISSIVE OF USE...



...with marketing geared
toward attracting young users.

Festival Hangover? Our Top Cannabis Goods
To Save The Day



How to Dab



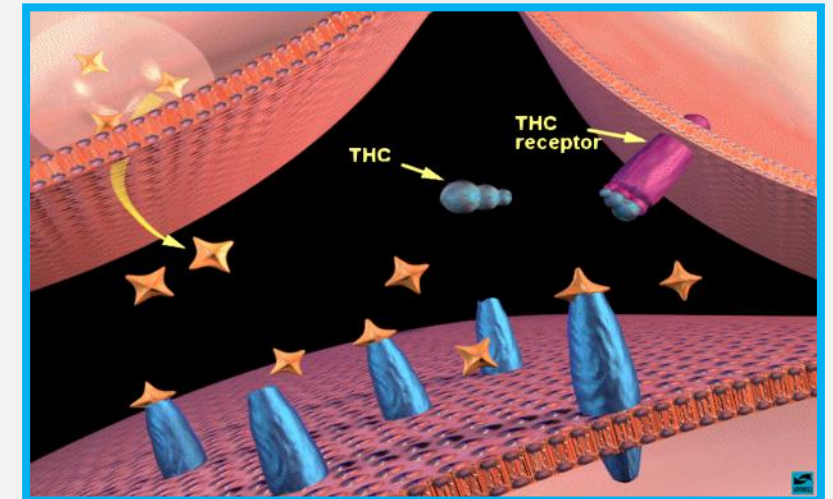
Here Are the Most Epic Rap
Lyrics About Weed

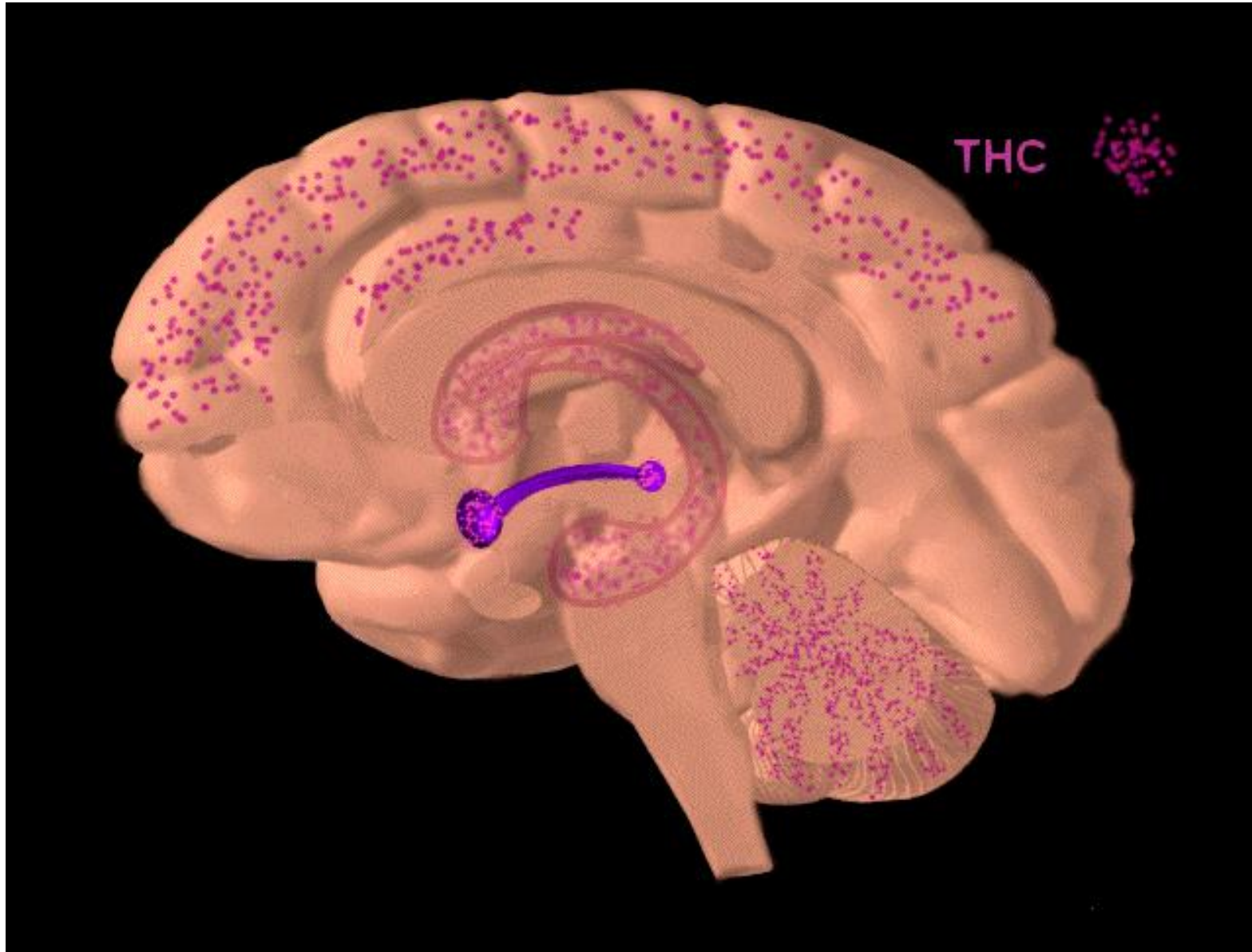


Cannabis and Sex Throughout History

>200 PHYTOCANNABINOIDS IN THE CANNABIS PLANT

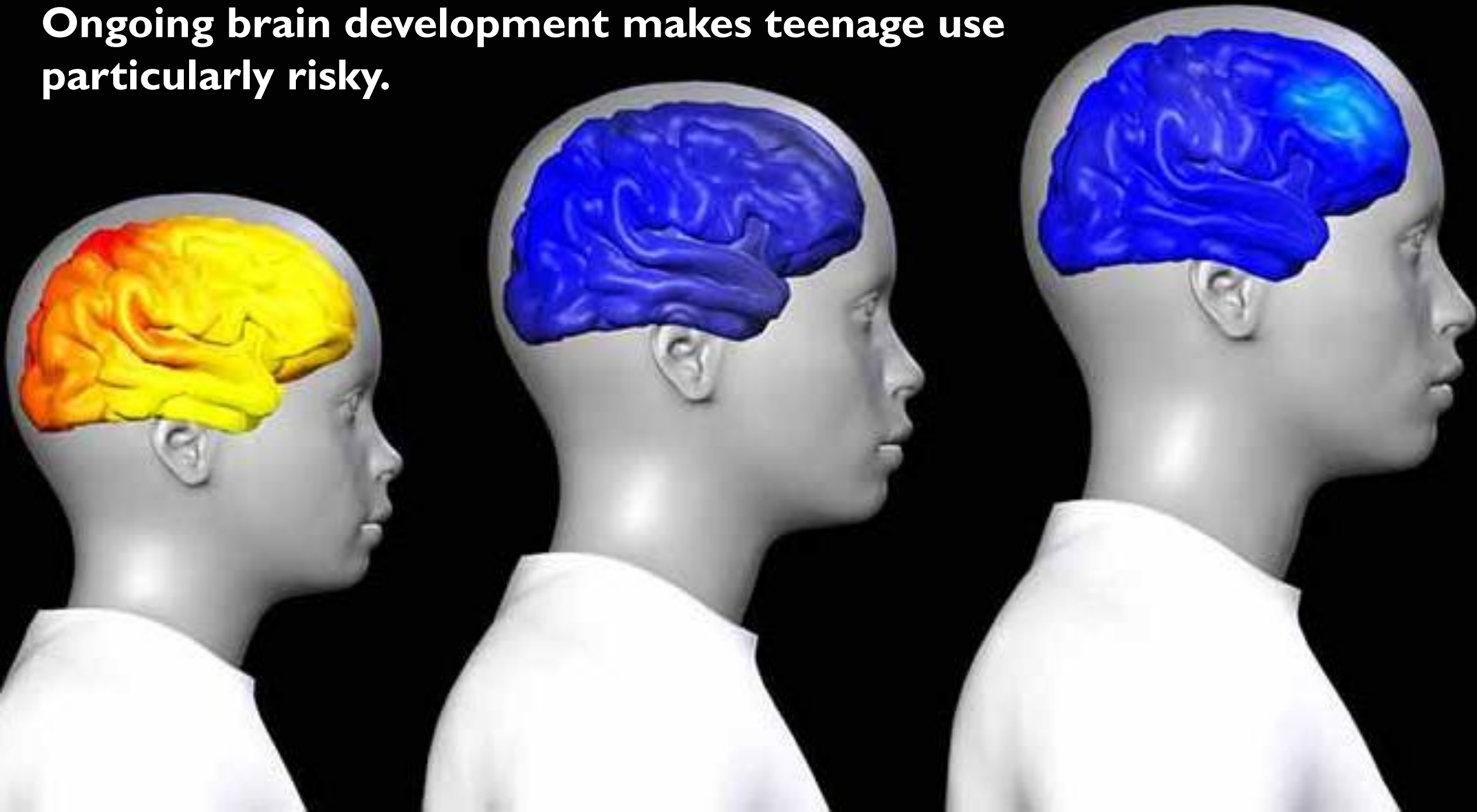
- Δ^9 -tetrahydrocannabinol (THC)
 - Agonist on endogenous cannabinoid receptors in the central (CB1) and peripheral (CB2) nervous system
 - > affinity than endogenous ligand, anandamide
 - Euphoric effect comes from THC
 - Lipophilic and crosses the BBB and placenta
 - Prenatal exposure → hyperactivity, impulsivity and inattention symptoms in childhood
 - Elimination half-life of days-weeks
- Other cannabinoids (e.g., CBD) that do not cause intoxication
 - More commonly discussed when speculating about treatment of neurologic disease (e.g., epilepsy)





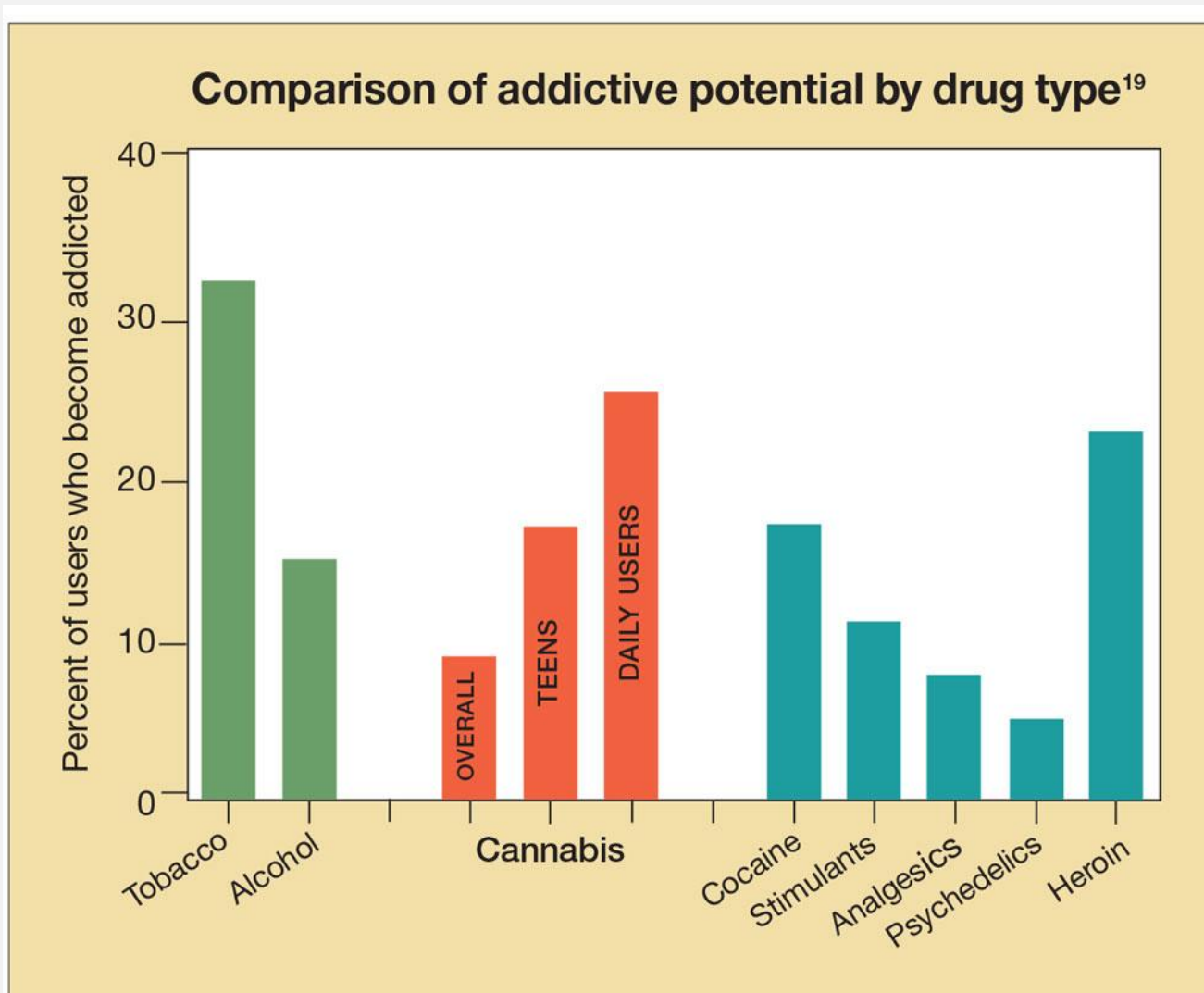
BROAD
DISTRIBUTION
OF THC
BINDING SITES

Ongoing brain development makes teenage use particularly risky.



ACUTE EFFECTS OF CANNABIS ARE WELL PROFILED

- Typically peaks 30 minutes after inhalation and 2-4 hours after ingestion
- +: Relaxation, euphoria, heightened perception, sociability, sensation of time slowing, increased appetite, decreased pain
- -: Paranoia, anxiety, irritability, impaired short-term memory, poor attention and judgment, and poor coordination and balance, tachycardia, hypertension, dry mouth and throat
 - Also 2-fold increased odds of respiratory symptoms among those who vape cannabis (Boyd et al., 2021)
- ↑ with THC content
- Tolerance may occur but, effects typically still detectable



ADDICTION LIABILITY

- 4M people aged 12+ have a past year CUD
- ~23% of people who received addiction treatment received treatment for CUDs
- Average adult entering tx for CUD has used daily for 10 years, tried to quit 6 times

SIGNS OF CANNABIS DEPENDENCE

Tolerance/withdrawal

- Anger or Aggression
- Decreased Appetite / Weight Loss
- Irritability
- Nervousness / Anxiety
- Restlessness
- Sleep Difficulties / Strange Dreams

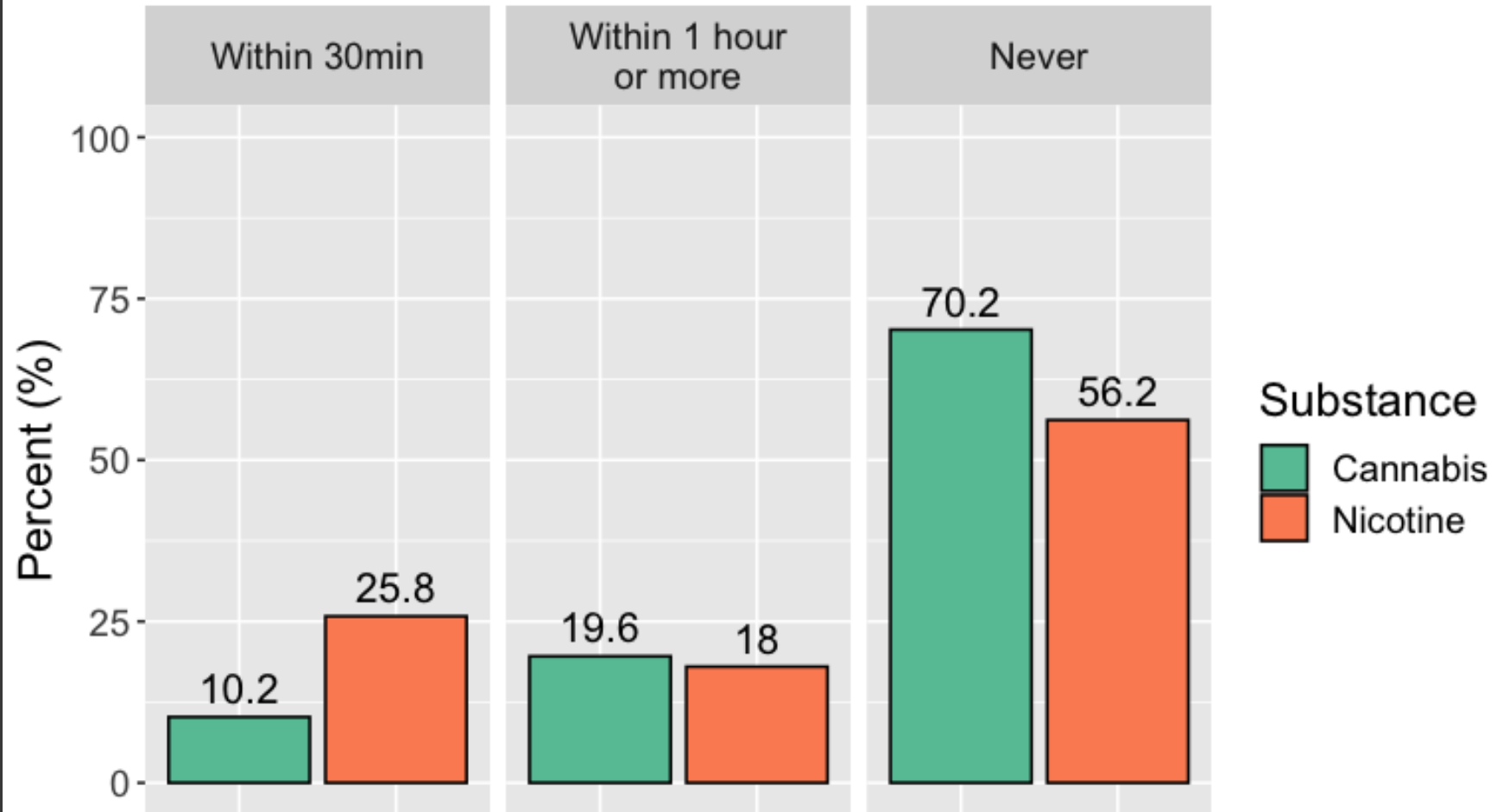
Preoccupation

Loss of control

Continued use in the face of adverse consequences

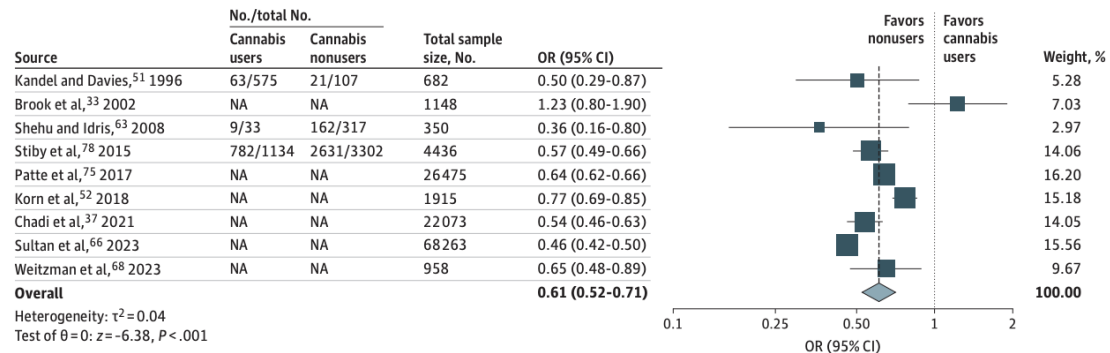
Cognitive distortions/denial

Cannabis and Nicotine Craving



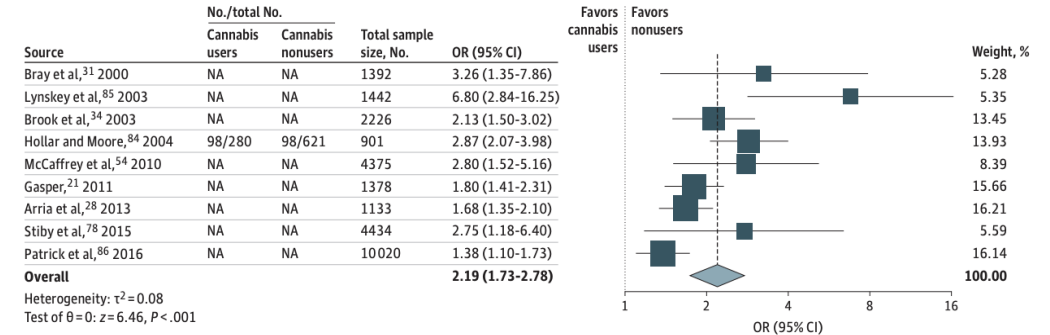
Cannabis Use During Adolescence and Academic Achievement

Figure 2. Achievement of a School Grade of A or B



Six studies reported both adjusted and unadjusted data, and only the adjusted data were used. NA indicates not applicable because adjusted data were used; OR, odds ratio.

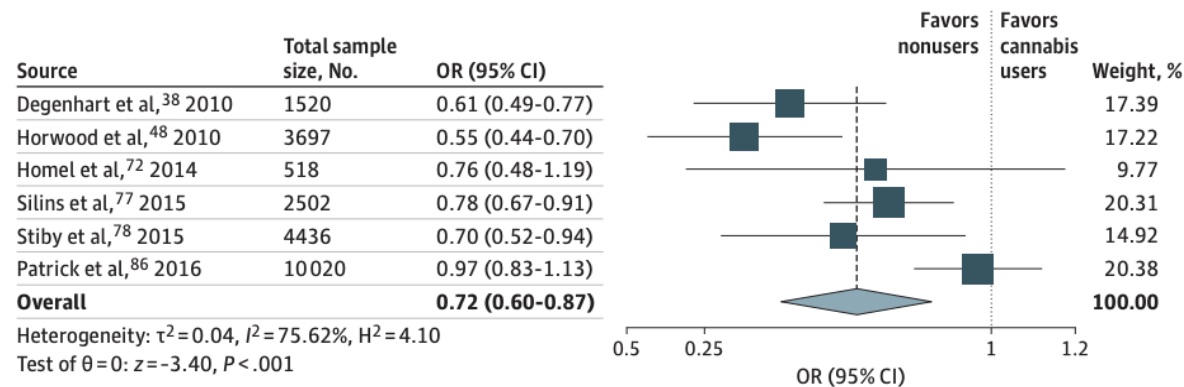
Figure 3. Forest Plot for School Dropout



Eight studies reported both adjusted and unadjusted data, and only the adjusted data were used. Due to a significant subgroup effect for high vs low risk of bias in the validity of the outcome measure ($P < .001$, moderate

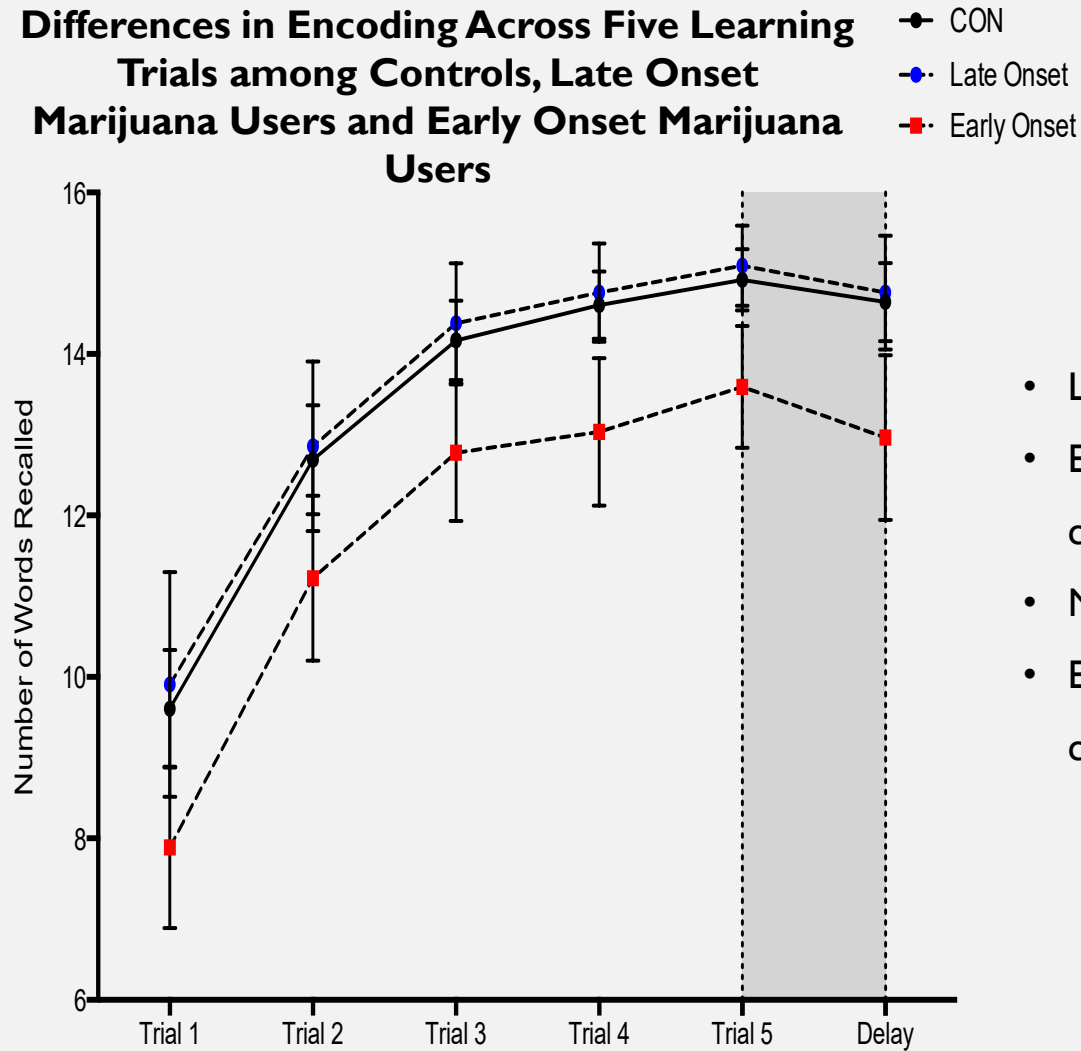
credibility), the primary analysis of school dropout was performed among the studies with low risk of bias. NA indicates not applicable because adjusted data were used; OR, odds ratio.

Figure 4. Forest Plot for University Enrollment



Five studies reported both adjusted and unadjusted data, and 1 study reported adjusted data only. Adjusted data were used from all of the 6 studies due to the significant difference between studies with adjusted and unadjusted data ($P = .01$, moderate credibility). OR indicates odds ratio.

Differences in Encoding Across Five Learning Trials among Controls, Late Onset Marijuana Users and Early Onset Marijuana Users



- Learning improved with repetition, with no group effect on the learning slope
- Early users learned < words overall than late onset users or CON; Late onset = controls
- No differences in percent retention
- Early users used < overall learning strategies and < semantic clustering than controls

NEUROCOGNITIVE RECOVERY WITH CANNABIS ABSTINENCE

Randomized Controlled Trial > J Clin Psychiatry. 2018 Oct 30;79(6):17m11977.
doi: 10.4088/JCP.17m11977.

One Month of Cannabis Abstinence in Adolescents and Young Adults Is Associated With Improved Memory

Randi Melissa Schuster^{1 2}, Jodi Gilman², David Schoenfeld³, John Evenden⁴, Maya Hareli²,
Christine Ulysse³, Emily Nip², Ailish Hanly^{2 5}, Haiyue Zhang³, A Eden Evins²

Figure 1. Urine Creatinine-Adjusted THCCOOH Concentrations Among Abstinent and Non-Abstinent Cannabis Users^a

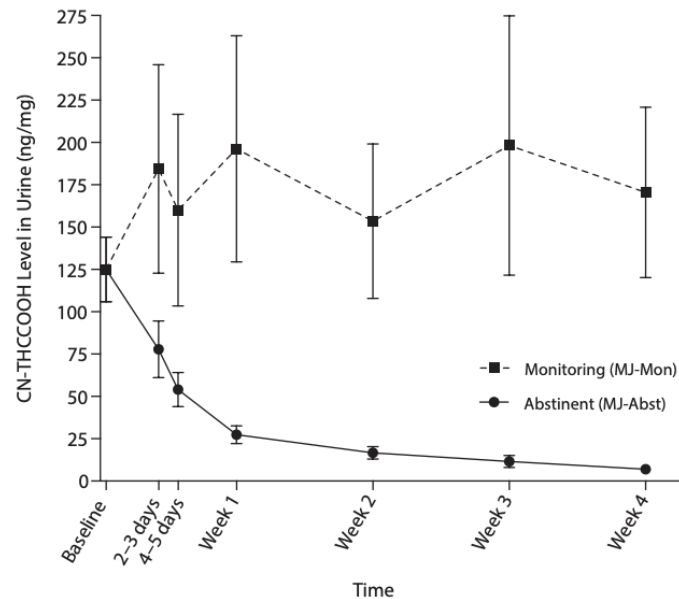
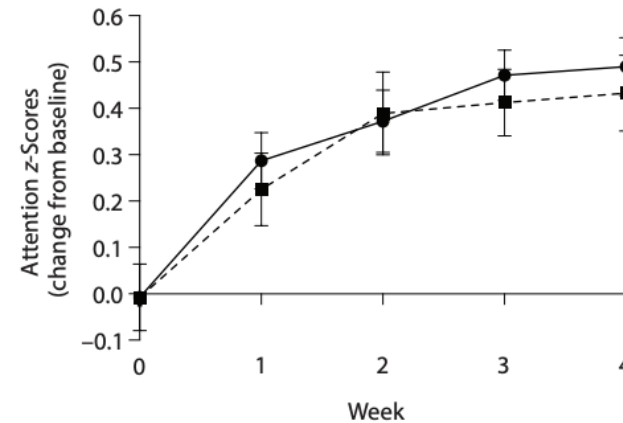
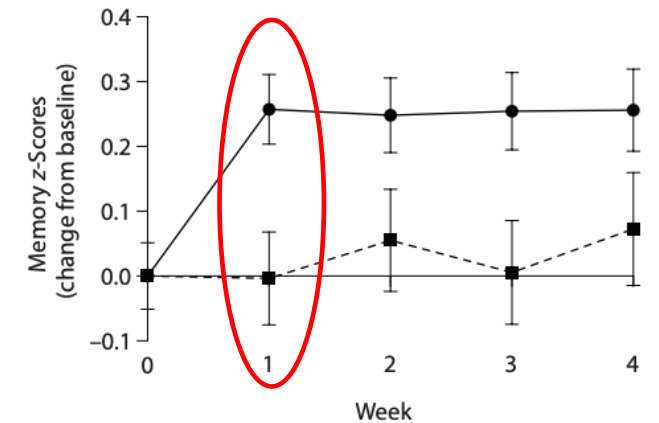


Figure 2. Change From Baseline in Cognitive Scores During 1 Month of Cannabis Abstinence or Continued Use^a

A. Attention^b



B. Memory^c



GREATER VULNERABILITY WITH PSYCHIATRIC DIAGNOSES?

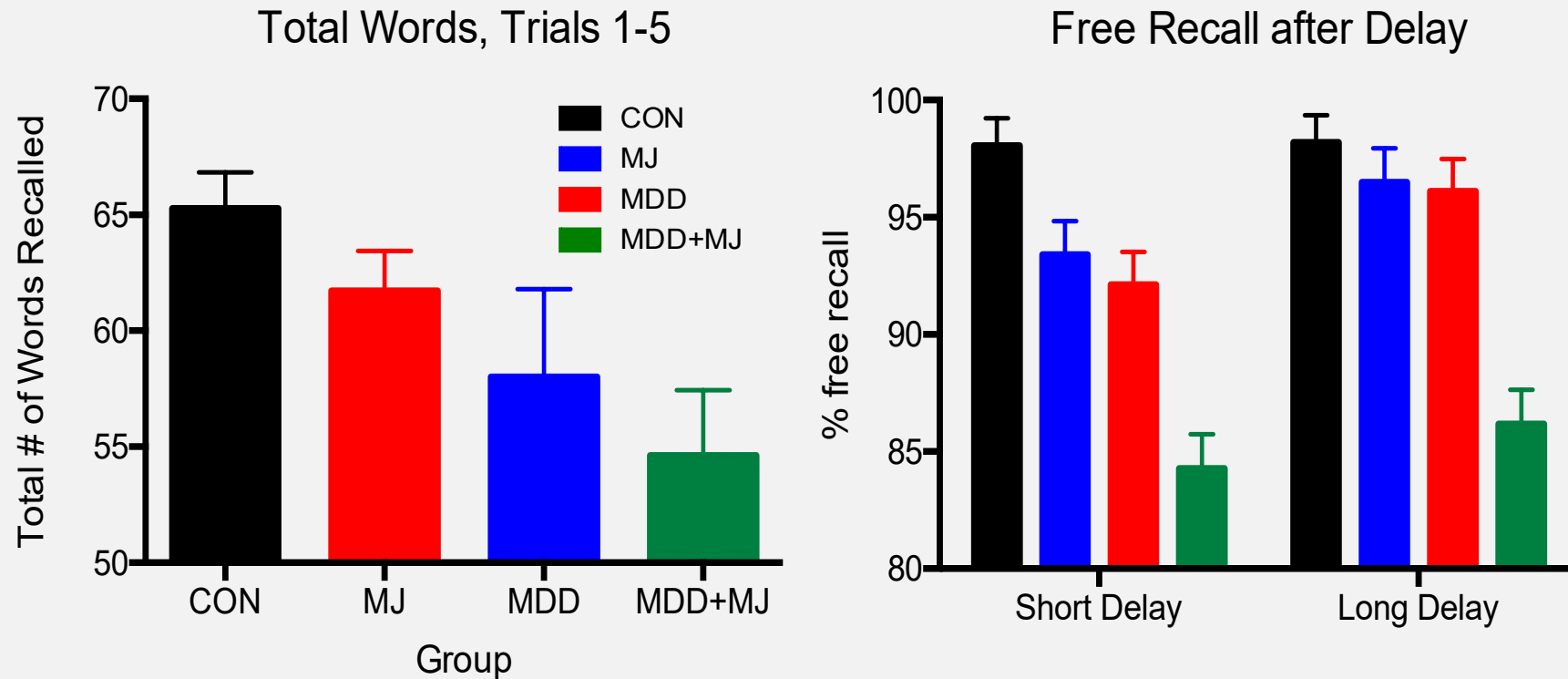
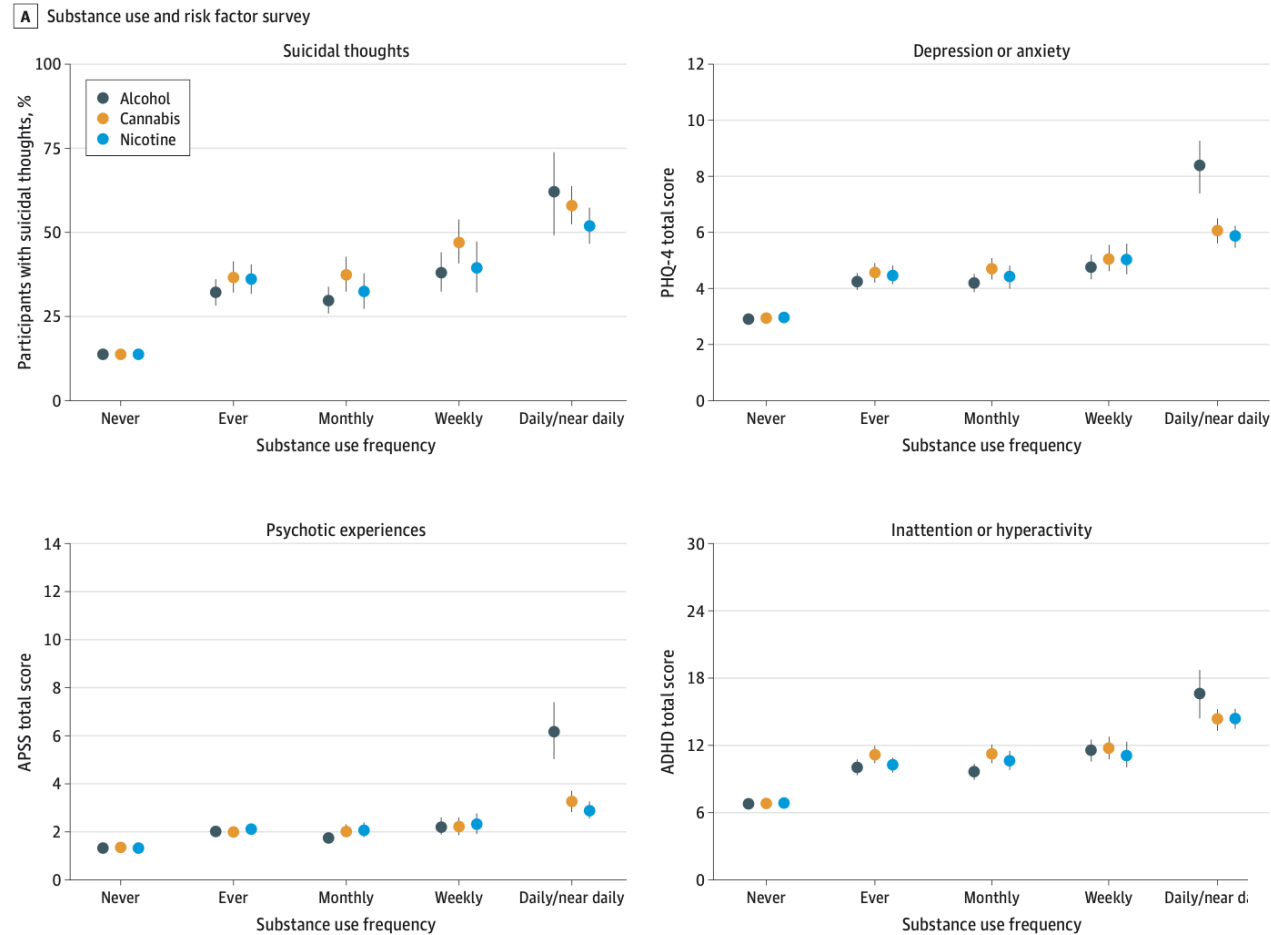




Figure. Associations Between Substance Use Frequency and Self-Reported Mental Health Symptoms in 2 Independent Samples of Adolescents



SUBSTANCE USE AND PSYCHIATRIC CO- MORBIDITIES

> [JAMA Pediatr.](#) 2024 Mar 1;178(3):310–313. doi: 10.1001/jamapediatrics.2023.6263.

Substance Use, Suicidal Thoughts, and Psychiatric Comorbidities Among High School Students

Brenden Tervo-Clemmens ¹, Jodi M Gilman ², A Eden Evins ², Kate H Bentley ²,
Matthew K Nock ³, Jordan W Smoller ², Randi M Schuster ²

RATES OF COMORBIDITY GREATER THAN CHANCE

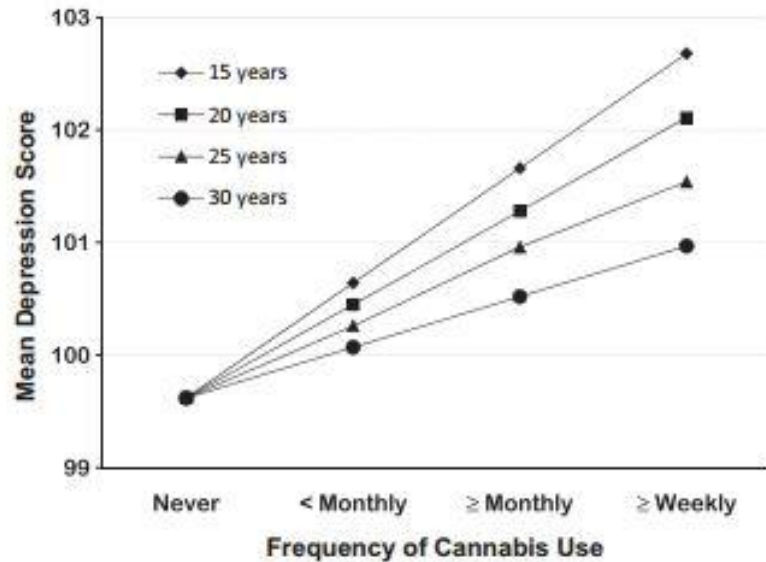


Fig. 1. Estimated associations between frequency of cannabis use and mean depression scores at selected ages (15, 20, 25, 30 years) after adjustment for fixed sources of confounding.

Depressed patients more likely to use cannabis

Cannabis users more likely to have to depression

ICD-10 depressive illness was nearly 4X higher among those with a cannabis use disorder, compared to those without a depressive illness

Many longitudinal studies show this relationship even after controlling for confounding variables

Among patients with MDD, cannabis is associated with:

↑ anhedonia, change in body weight, insomnia or hypersomnia, and psychomotor agitation or retardation

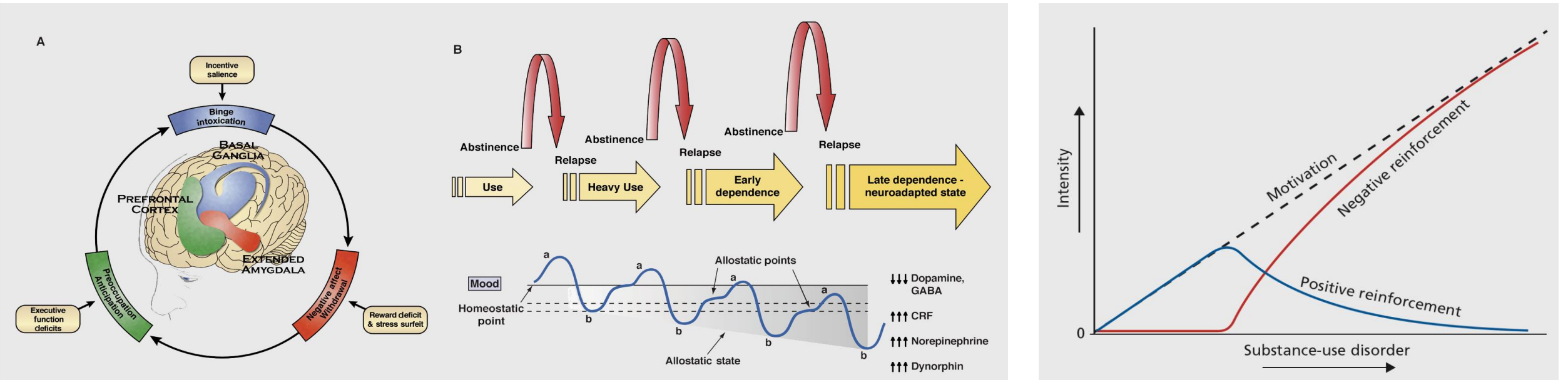
More symptoms

↑ depressive episodes

Treatment failure

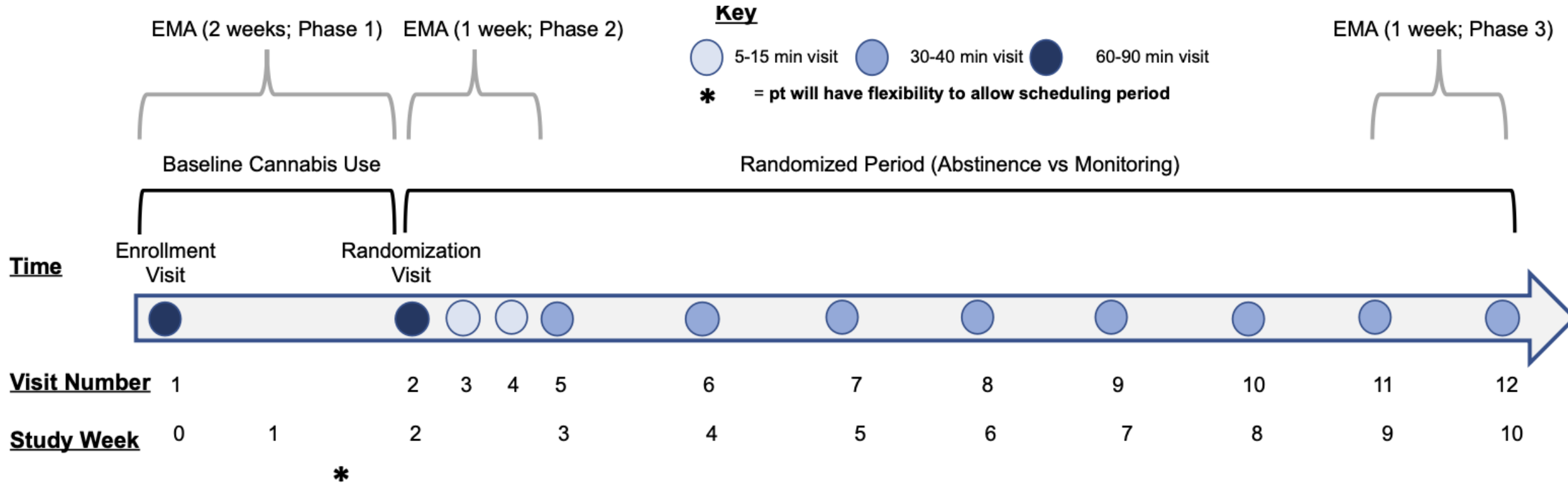
Why high rates of co-occurrence?

Figure 1. Progression of Drug Addiction Over Time and Accompanying Neuroadaptations Underlying Allostatic Changes Across the Stages of Drug Addiction (From George and Koob, 2017)



Negative reinforcement motivational theoretical model of addiction -- addiction may involve a transition from impulsive to compulsive behaviors and from positive to negative reinforcement over time

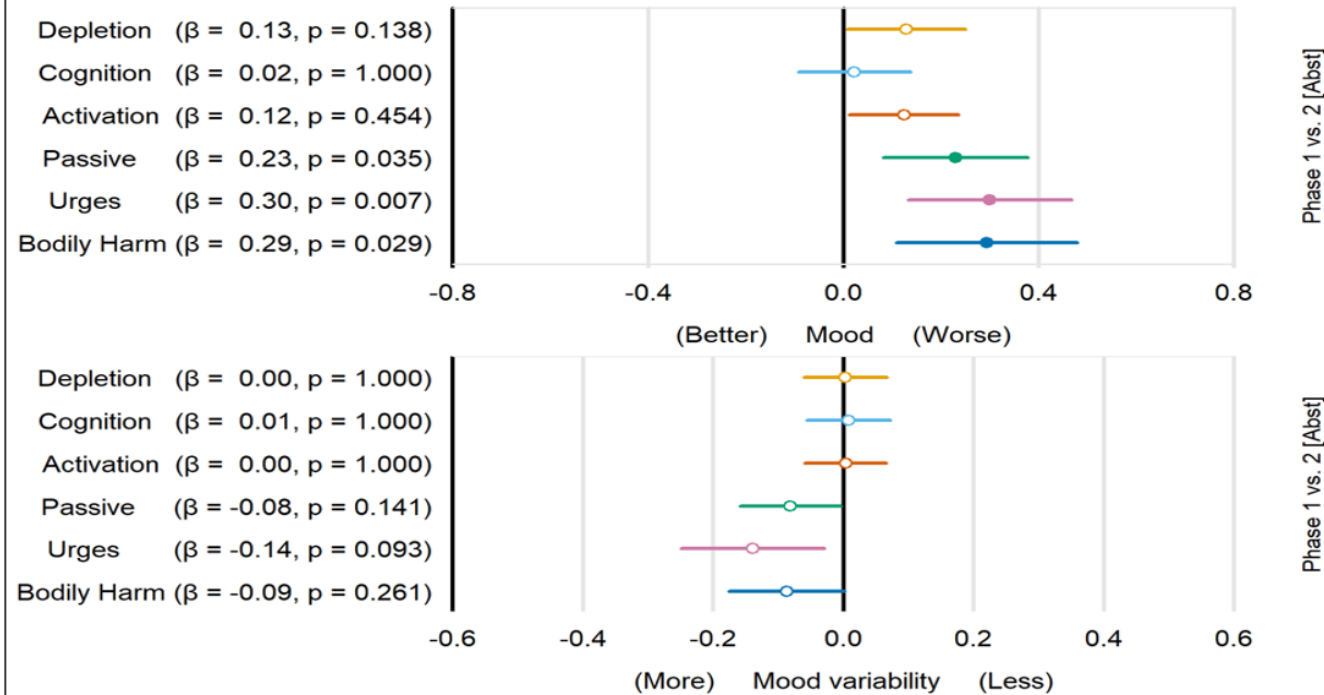
STUDY DESIGN



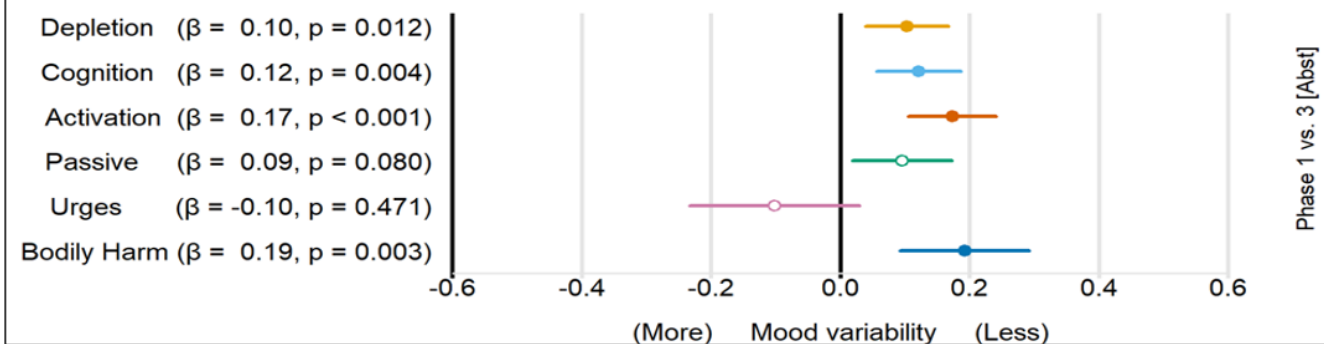
What Happens with Abstinence?

Figure 4. Pilot Analyses Using EMA During Cannabis Withdrawal and Sustained Abstinence

4A. Is cannabis withdrawal associated with changes in mean mood and mood lability (Phase 1 vs. Phase 2 in CB-Abst)?



4B. Is sustained cannabis abstinence associated with changes in mean mood and mood lability (Phase 1 vs. Phase 3 in CB-Abst)?

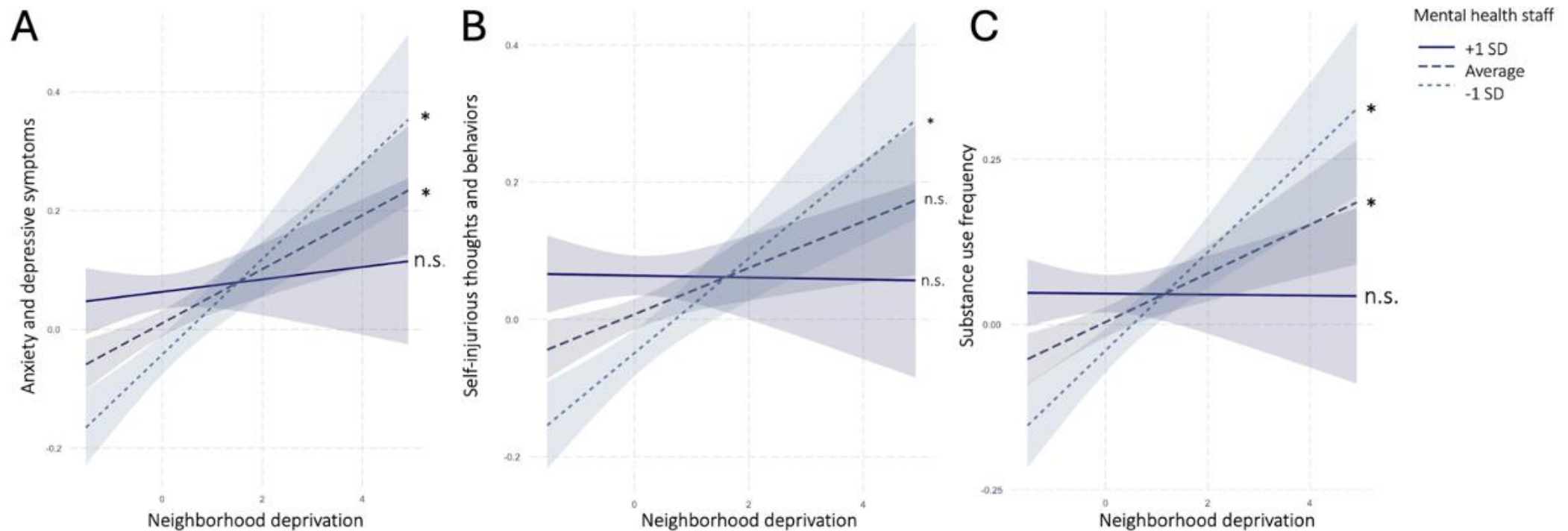




Need for schools to be mobilized to serve as the prevention hub of our mental health system

- Schools are a critical access point to improve equity
 - No-show rates for initial intake MH appointments range from 48-62%
 - 40-60% of children receiving outpatient MH services attend few sessions and drop out quickly
 - Schools provide greater access to mental health services

Interaction of neighborhood deprivation and mental health staff to student ratio predicting anxiety and depressive symptoms (A), self-injurious thoughts and behaviors (B), and substance use frequency (C), FDR corrected.





Alternatives to Punishment (Tier 2)

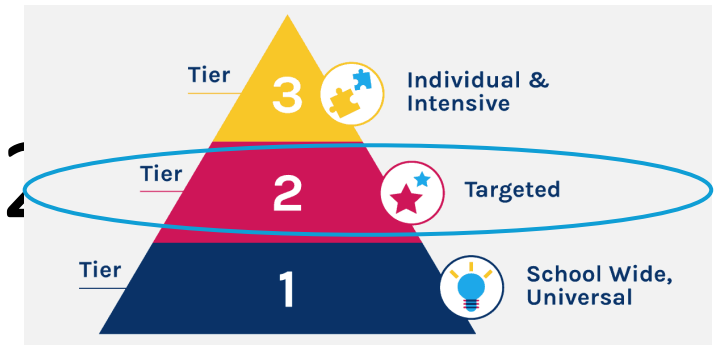
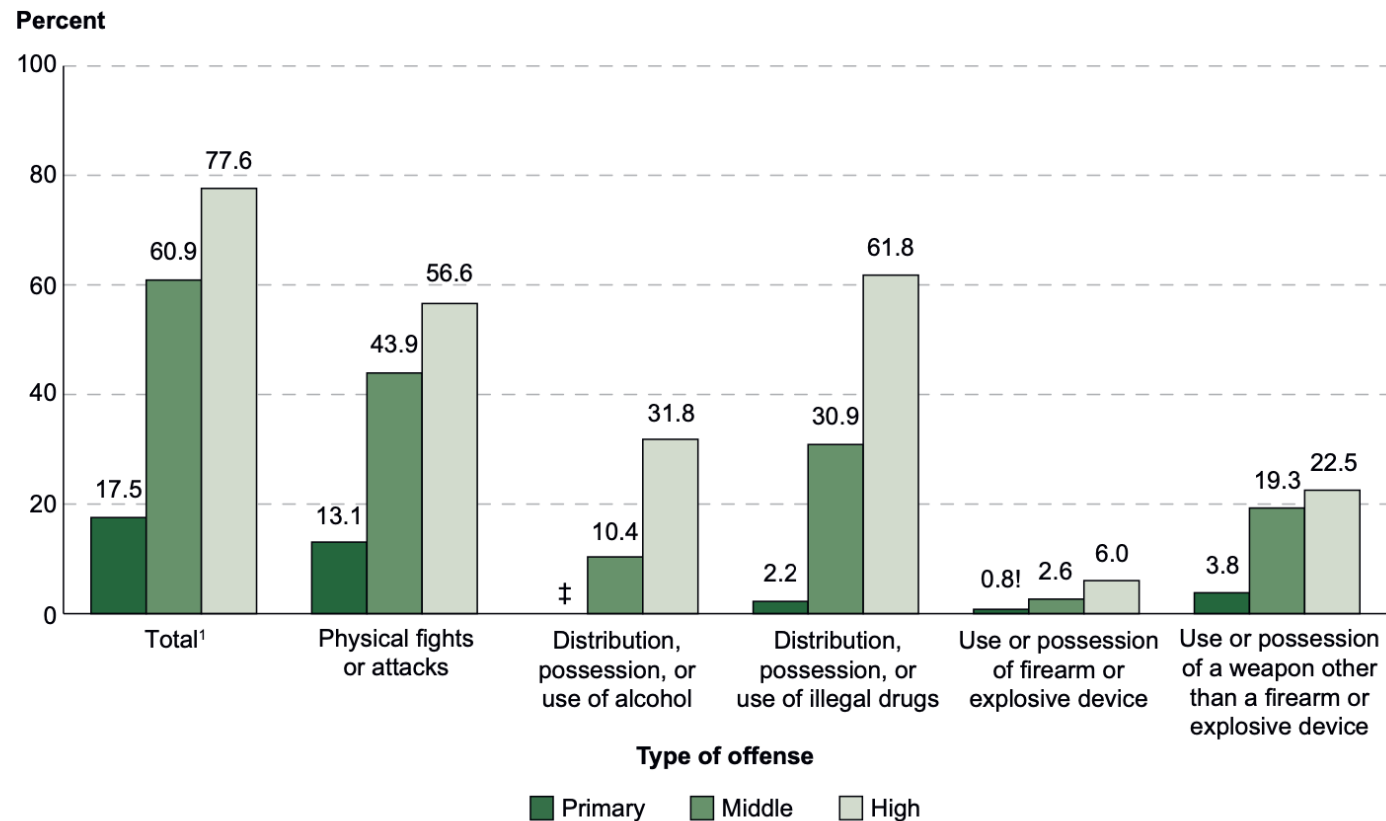
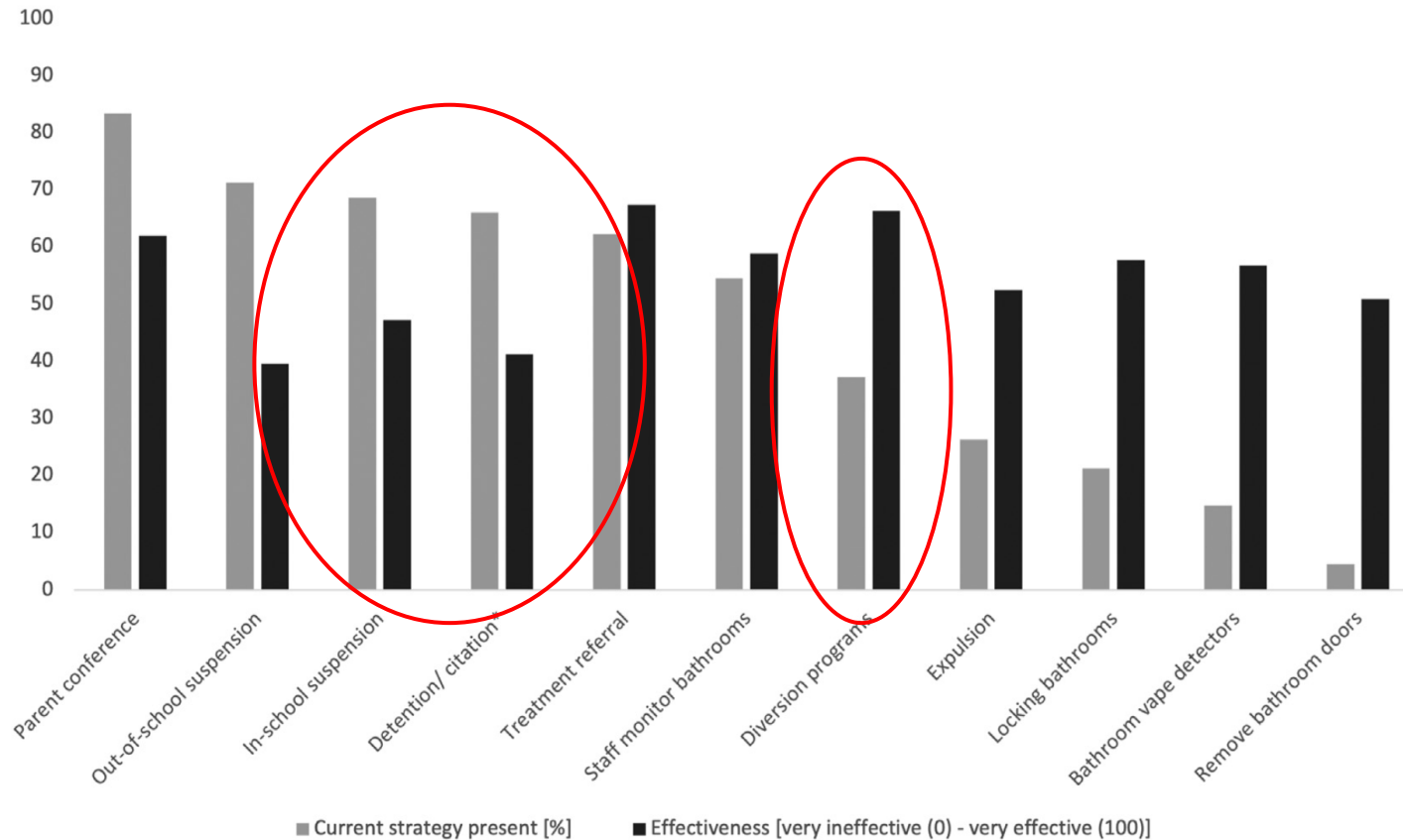
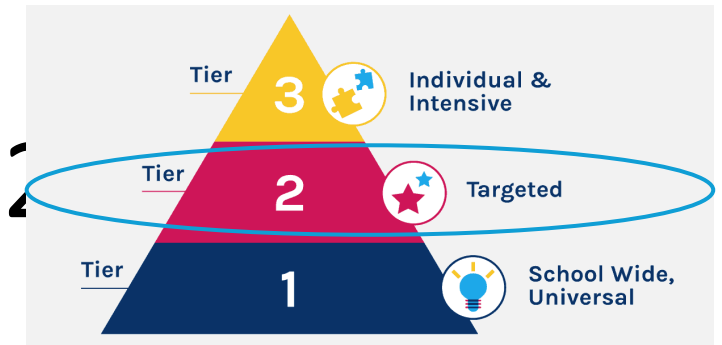


Figure 19.2. Percentage of public schools that took a serious disciplinary action in response to specific offenses, by type of offense and school level: School year 2015–16



Alternatives to Punishment (Tier 2)

J. Liu et al. / Journal of Adolescent Health 73 (2023) 428–436



Original article

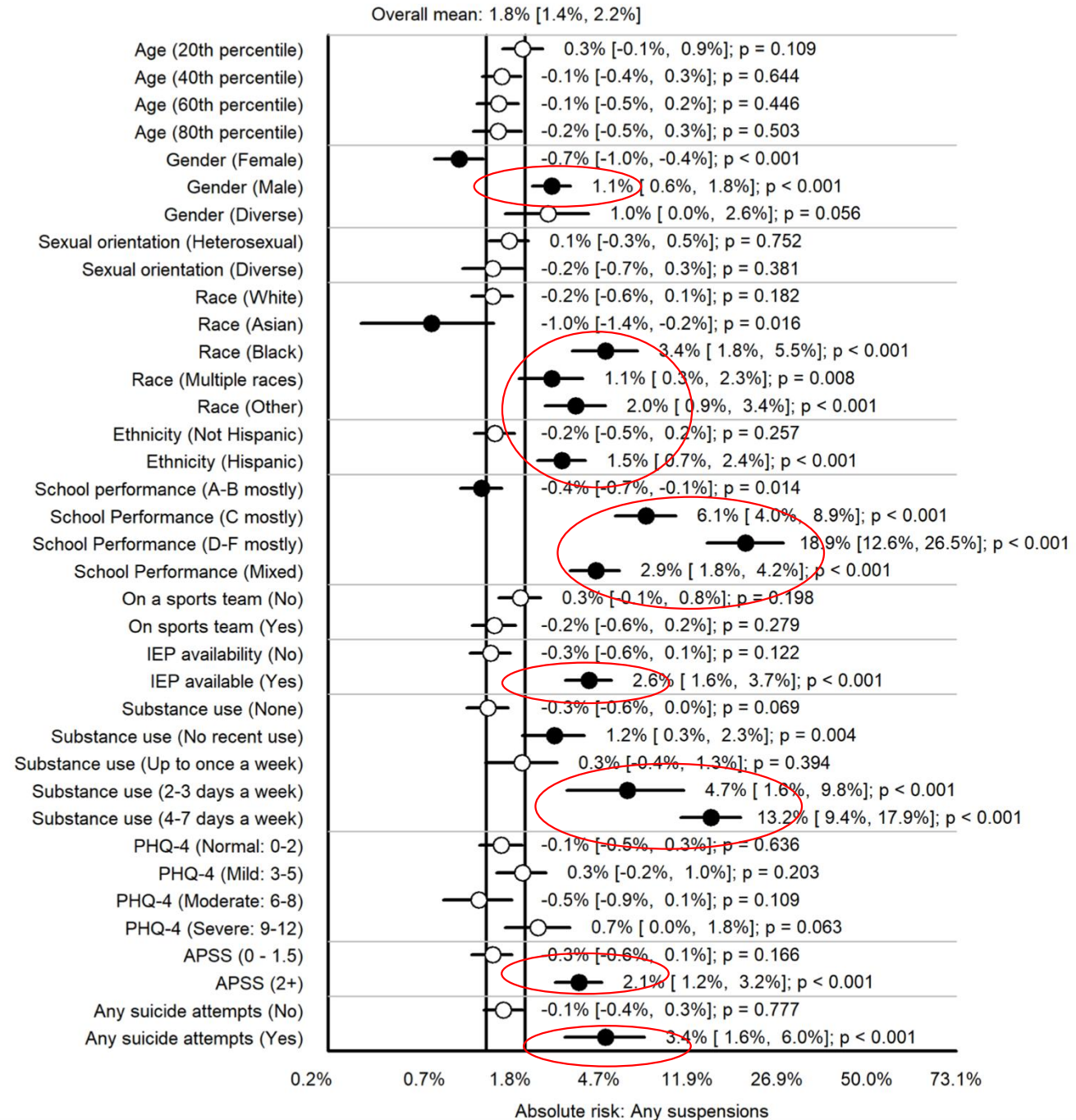
An Urgent Need for School-Based Diversion Programs for Adolescent Substance Use: A Statewide Survey of School Personnel

Jessica Liu, Ph.D.^a, Rebecca Butler, M.S.W.^b, Amy Turncliff, Ph.D.^c, Caroline Gray, M.S.W.^d, Stacey Lynch, M.S.W.^e, Jennie Whittaker, M.S.^e, Vanessa Iroegbulem^d, Dan Howell, M.P.H.^b, and Randi M. Schuster, Ph.D.^{d,f,*}

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HEALTH
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Characteristics of Students Suspended



OR_{male}=2.9

OR_{black}=5.2

OR_{+races}=2.9

OR_{other race}=3.8

OR_{Hispanic}=3.3

OR_{C grades}=7.9

OR_{D-F grades}=20.7

OR_{mixed grades}=4.7

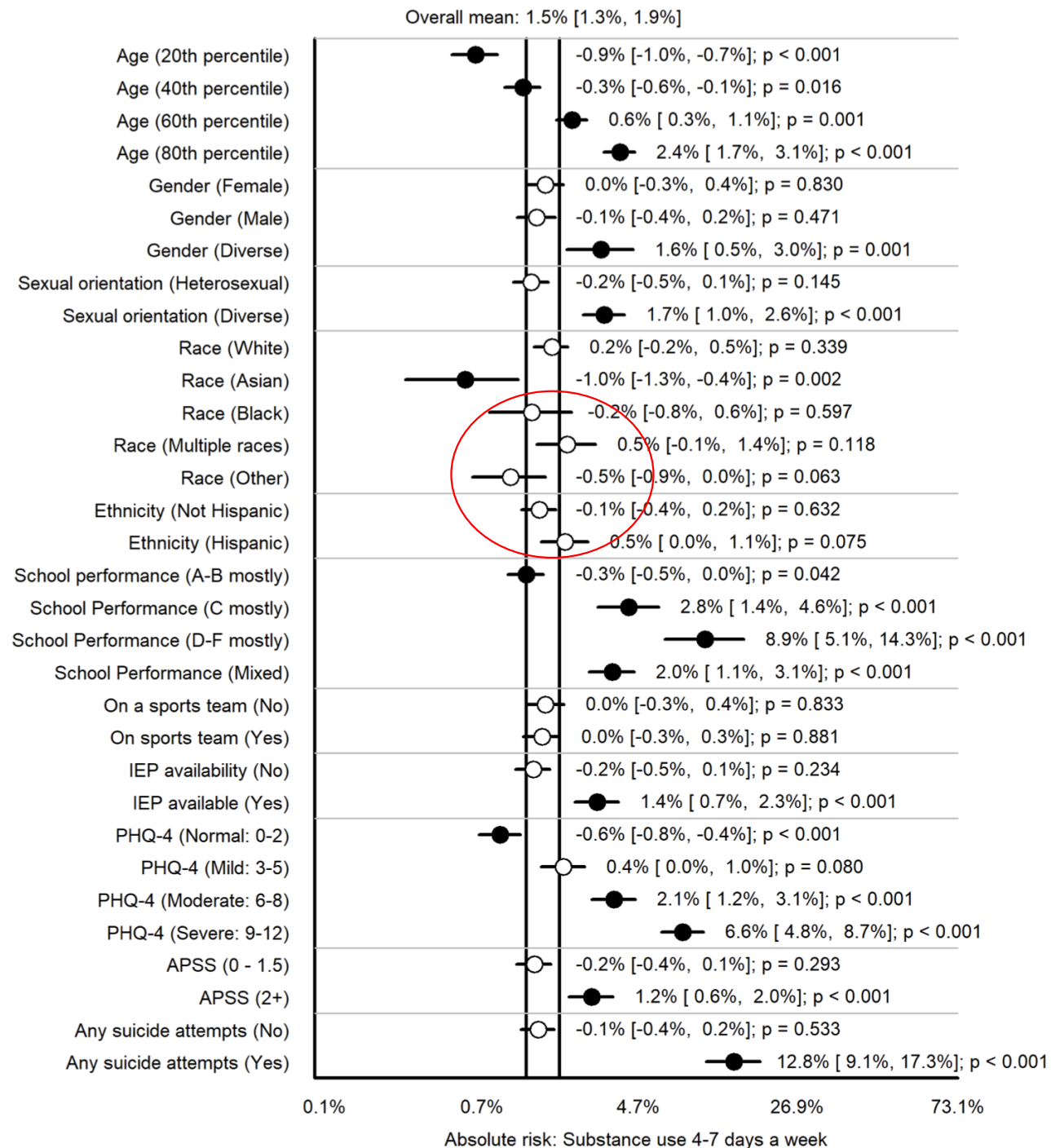
OR_{IEP}=4.4

OR_{SU 2-3 days/week}=6.5

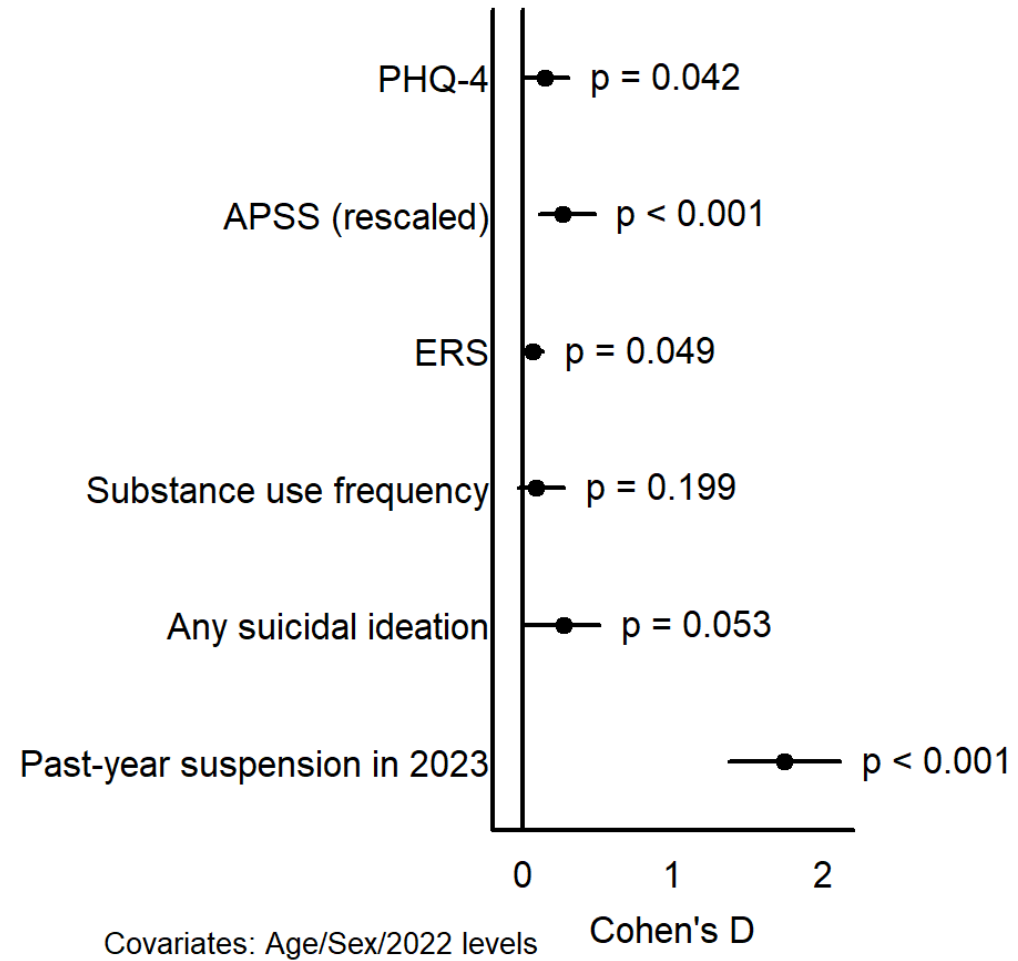
OR_{4-7 days/week}=15

OR_{APSS}=3.9

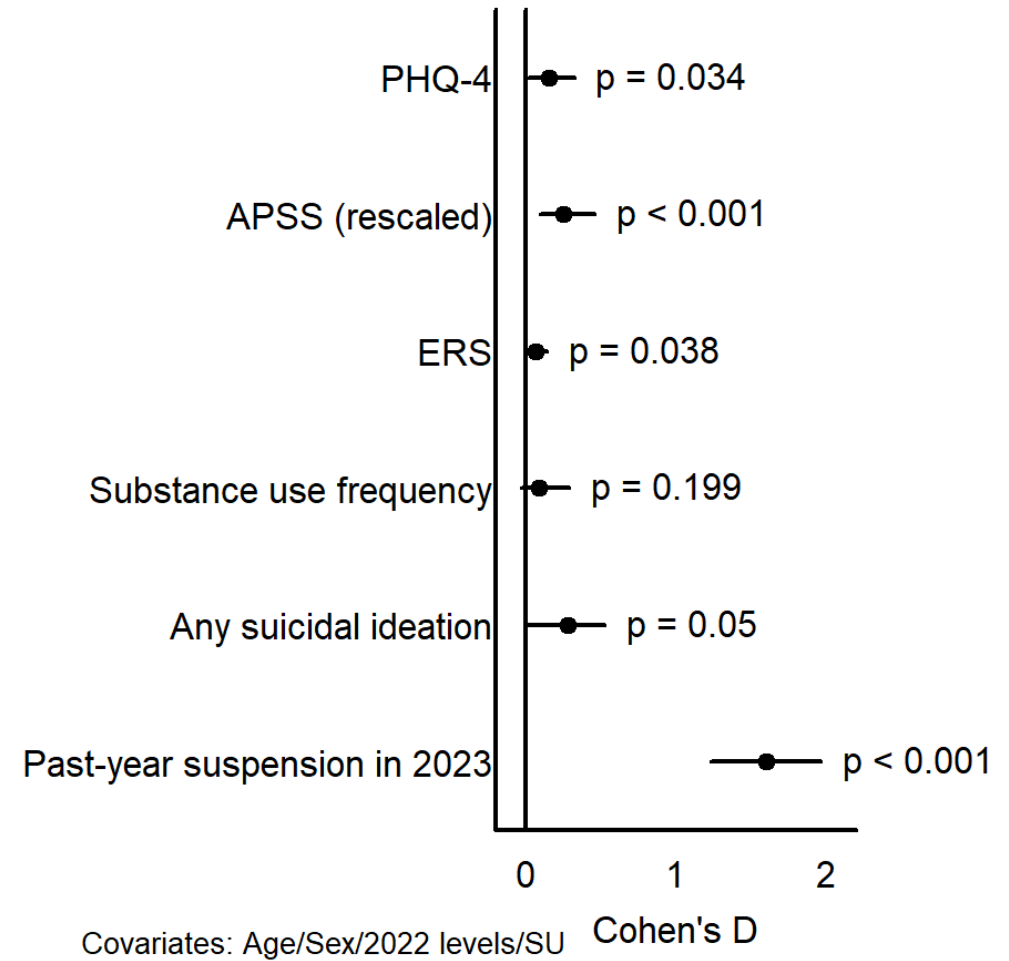
OR_{SI attempt}=5.2



Difference in 2023 Symptoms Among
Those Suspended Vs Not Suspended in 2022



Difference in 2023 Symptoms Among
Those Suspended Vs Not Suspended in 2022





iDECIDE Website



iDECIDE Overview Video



iDECIDE 25-26 Kick-Off



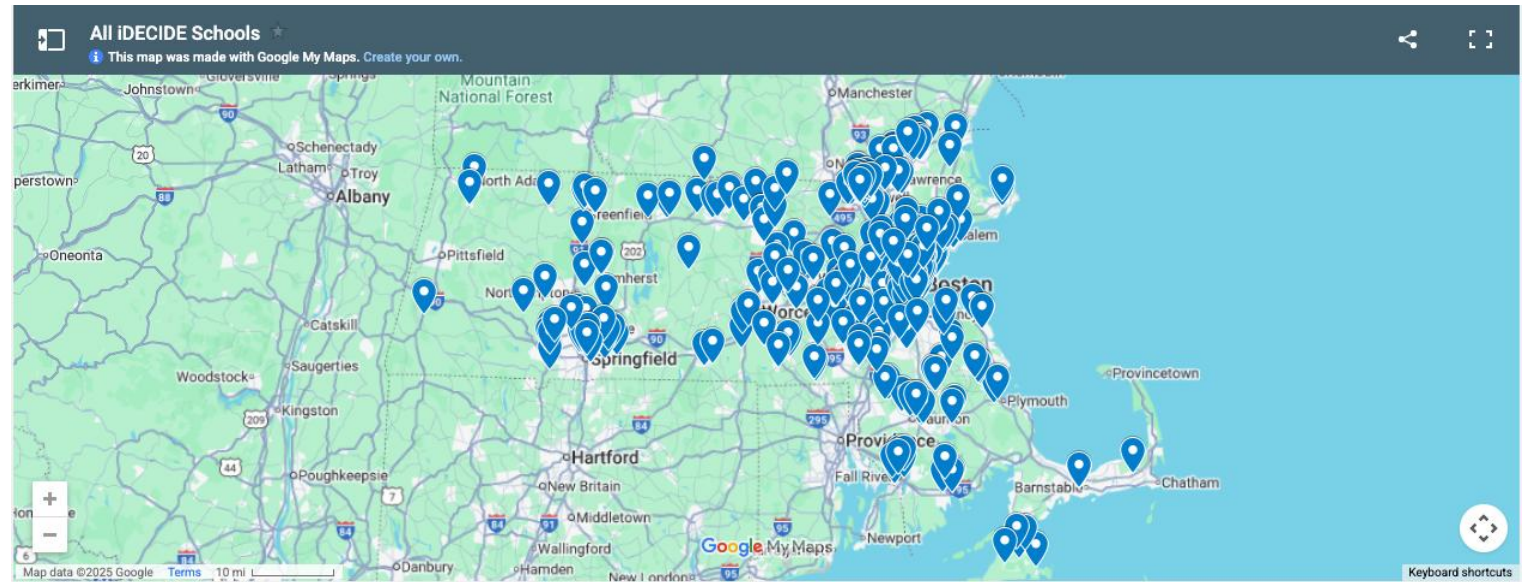
- **297 school partners**



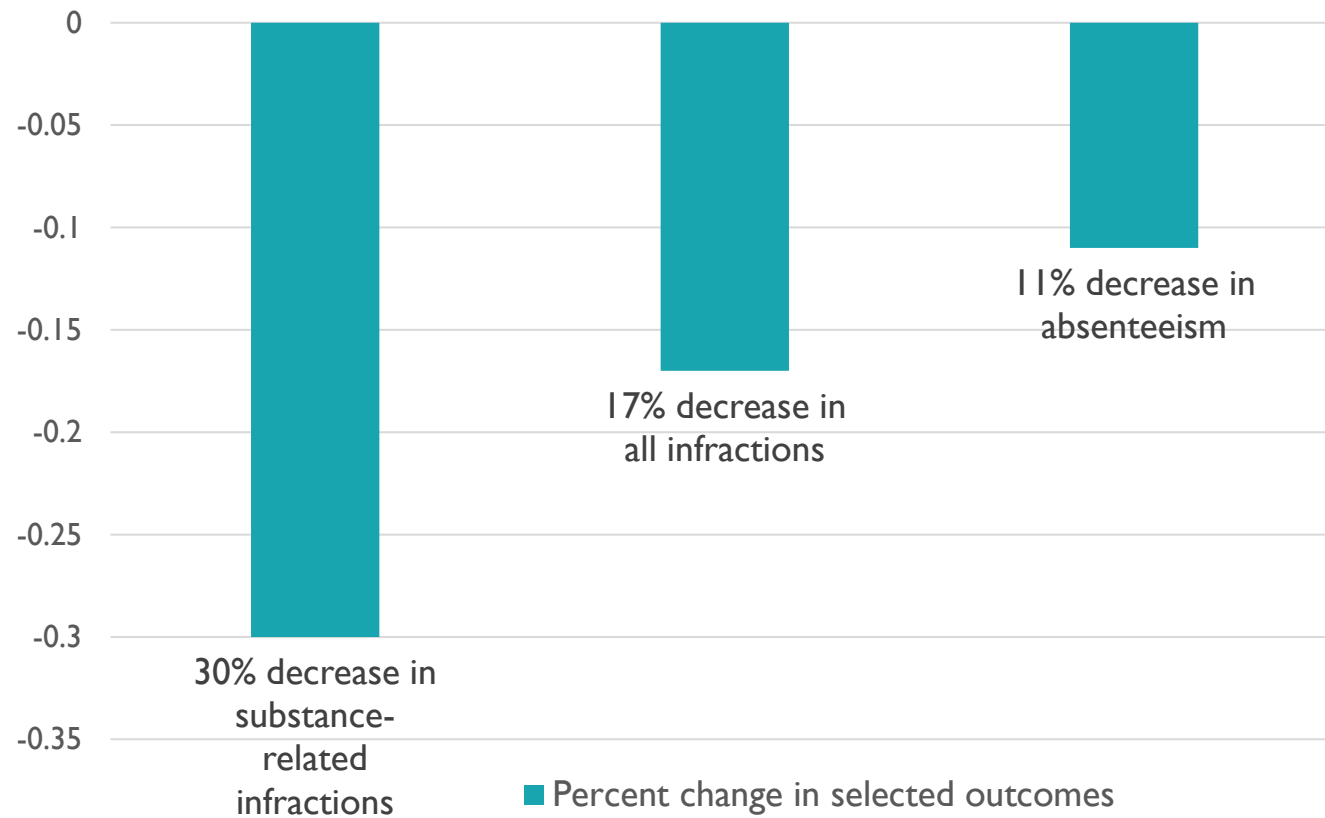
- **>50 iDECIDE facilitator trainings conducted**



- **1,500+ trained facilitators**

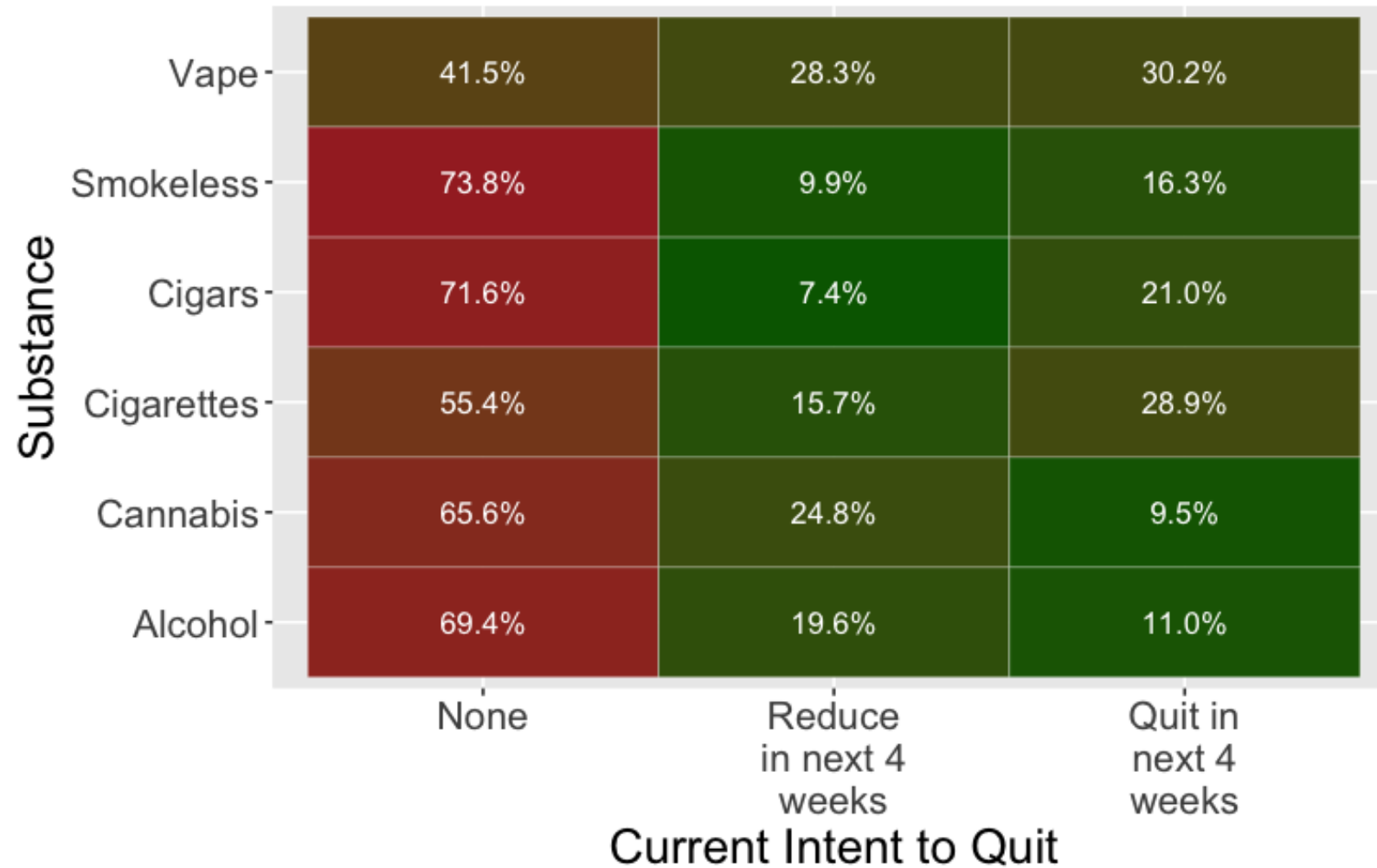


After implementing iDECIDE, schools experienced
a...



PRELIMINARY
FINDINGS

Student Intent to Quit



Please reach out with any questions or thoughts...



617-643-6673



RSCHUSTER@MGH.HARVARD.EDU