



Methamphetamine and HIV

Martin McElhiney, Ph.D.
Columbia University Medical Center
New York State Psychiatric Institute

Disclosures

“This program is supported by the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS) as part of an award totaling \$3,845,677 with zero percentage financed with nongovernmental sources. The contents are those of the author(s) and do not necessarily represent the official views of, nor an endorsement, by HRSA, HHS or the U.S. Government.”

Disclosures continued

The author has no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in this presentation. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

Overview

1. What is methamphetamine (Meth)?
2. History of amphetamines
3. Substance use trends in the U.S.
4. Use of meth in the U.S. and N.Y.C.
5. Methods and patterns of use
6. Meth in the gay & HIV communities
7. Meth and the brain
8. Long-term effects of meth use
9. Medical complications
10. Treatment of meth abuse
11. Medication trials
12. Behavioral trials
13. Treatment options

What is methamphetamine?

- Amphetamines are a family of synthetic stimulants that exist in 3 chemical forms:
 1. Amphetamine sulfate
 - a) Benzedrine
 - b) “Speed” – powder, paste or crystals
 2. Dextroamphetamine
 - a) Dexedrine – primarily prescribed for ADHD, narcolepsy and weight loss
 - b) Adderall - prescribed for ADHD
 3. Methamphetamine
 - a) Methadrine – prescribed for weight loss and depression in the 1950s
 - b) Desoxyn – prescribed for ADHD and weight loss
 - c) Crystal Meth – crystalline solid

A Brief History of Methamphetamine

- 1887: Amphetamine was first synthesized by the German chemist L. Edeleano.
- 1939: Methamphetamine was used by Germany, Japan and the U.S. during WWII to increase alertness and decrease fatigue (e.g. long-distance pilots).
- 2005: Congress passed the “Combat Methamphetamine Act” which made it difficult to buy Pseudoephedrine, an ingredient used to make Meth.

A Brief History of Methamphetamine

There have been 3 eras of methamphetamine use in the U.S.

- 1950's - methamphetamine was prescribed for weight loss and depression. It was used by students, truck drivers, athletes and abuse spread.
- Late 1960's - Increased availability of the injectable form worsening abuse potential.
- 1990's - Current epidemic began.

Substance Use in the U.S.

Data from the National Survey on Drug Use and Health (NSDUH) – 2019

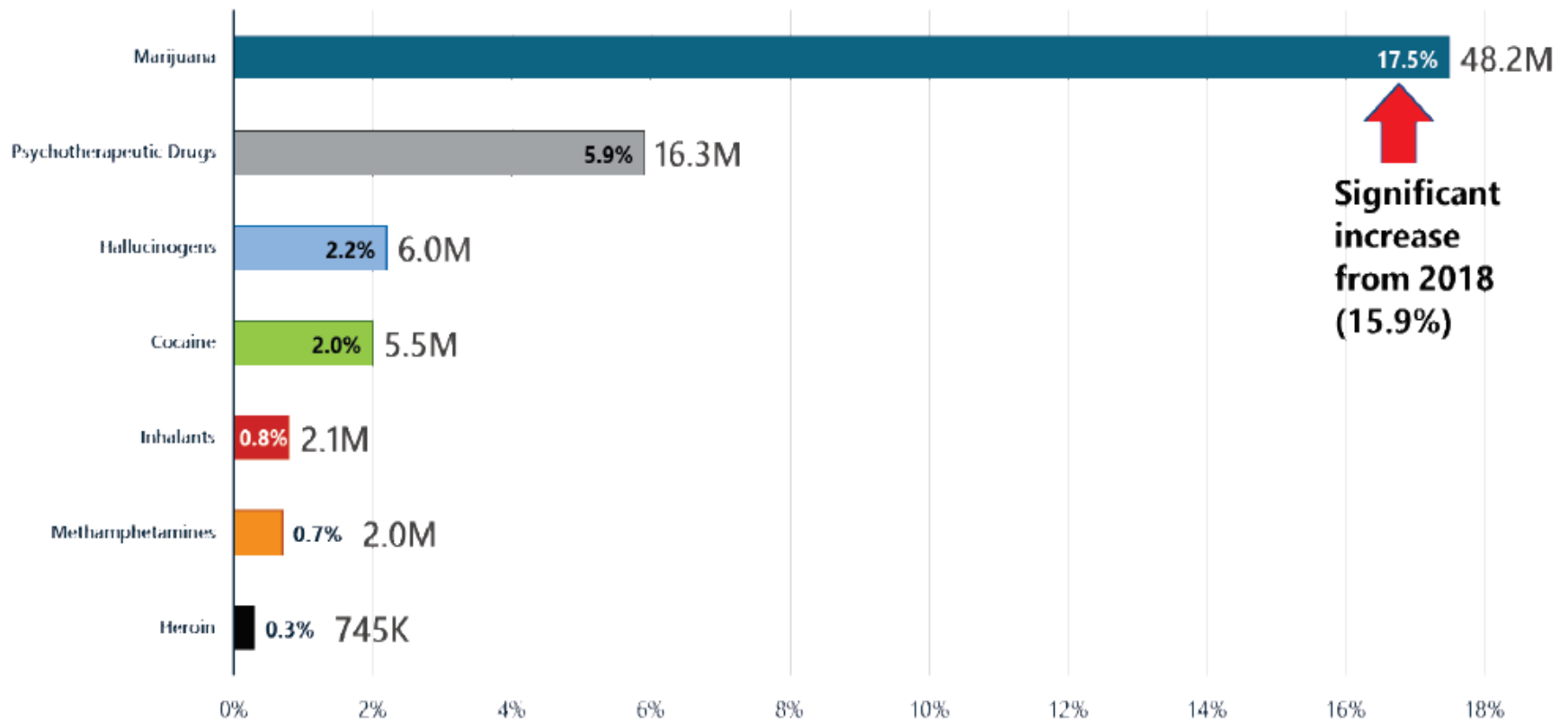
- Data collected by the Substance Abuse and Mental Health Services Administration (SAMHSA) – U.S. Department of Health and Human Services.
- Interview regarding substance use, substance use disorders, and mental health.
- Sample includes data collected from all 50 states and D.C.
- 67,500 persons interviewed annually
- Provides a snapshot of substance use in the U.S.

Data is presented in age groups:

- 12-17
- 18-25
- 26 and older

Substance Use in the U.S.

Substances used during 2019

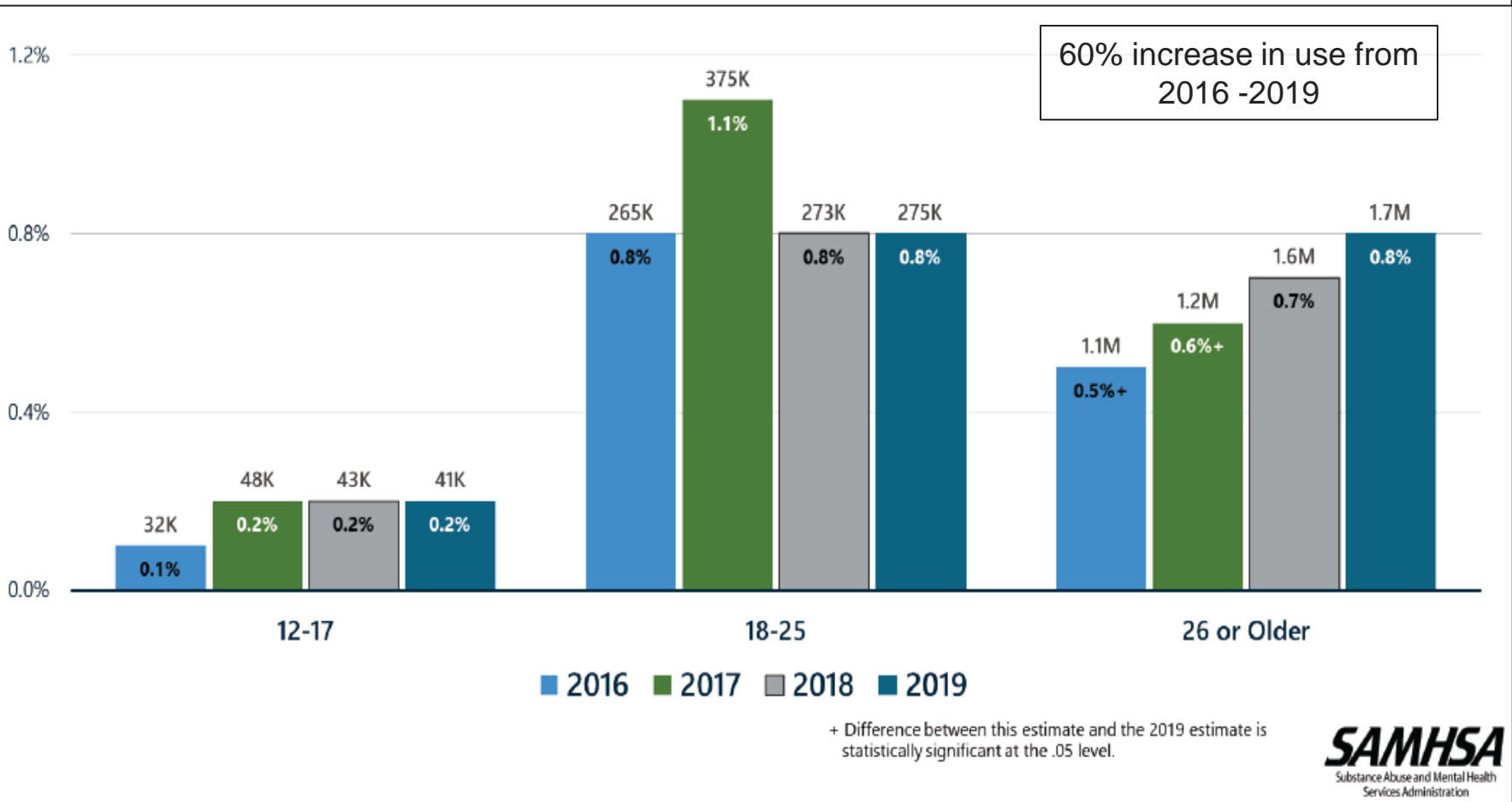


**Significant
increase
from 2018
(15.9%)**

SAMHSA
Substance Abuse and Mental Health
Services Administration

Substance Use in the U.S.

methamphetamine use trends 2016 – 2019

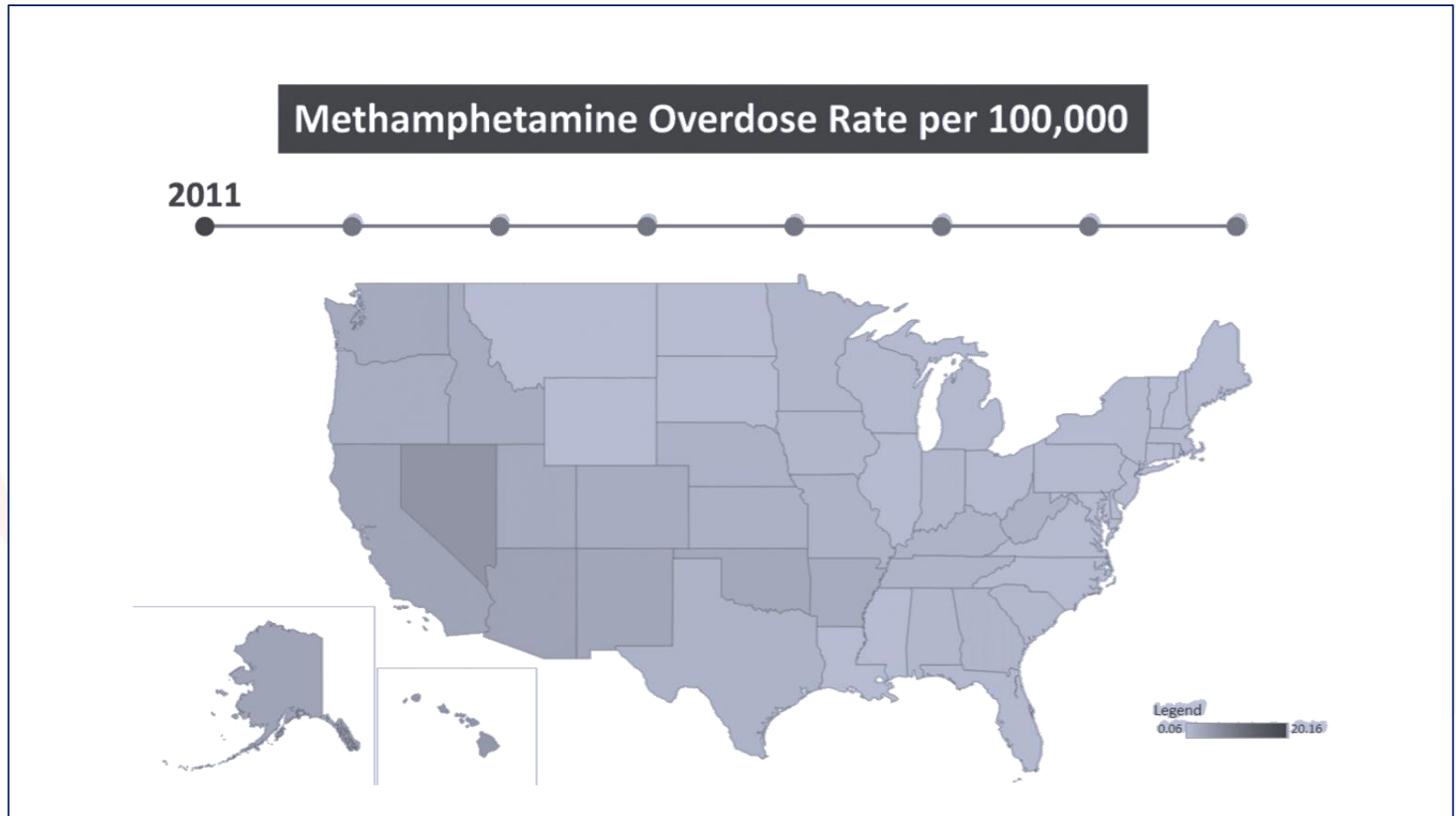


Methamphetamine Associated Overdose Deaths Among Adults in the U.S. (Han et al., 2021)

- Meth overdose deaths rates per 100,000 people rose from 2.4 to 5.0 from 2016-2019.
- Meth associated deaths rose 46%:
 - 16,011 (November 2018 – October 2019)
 - 23,352 (November 2019 – October 2020)

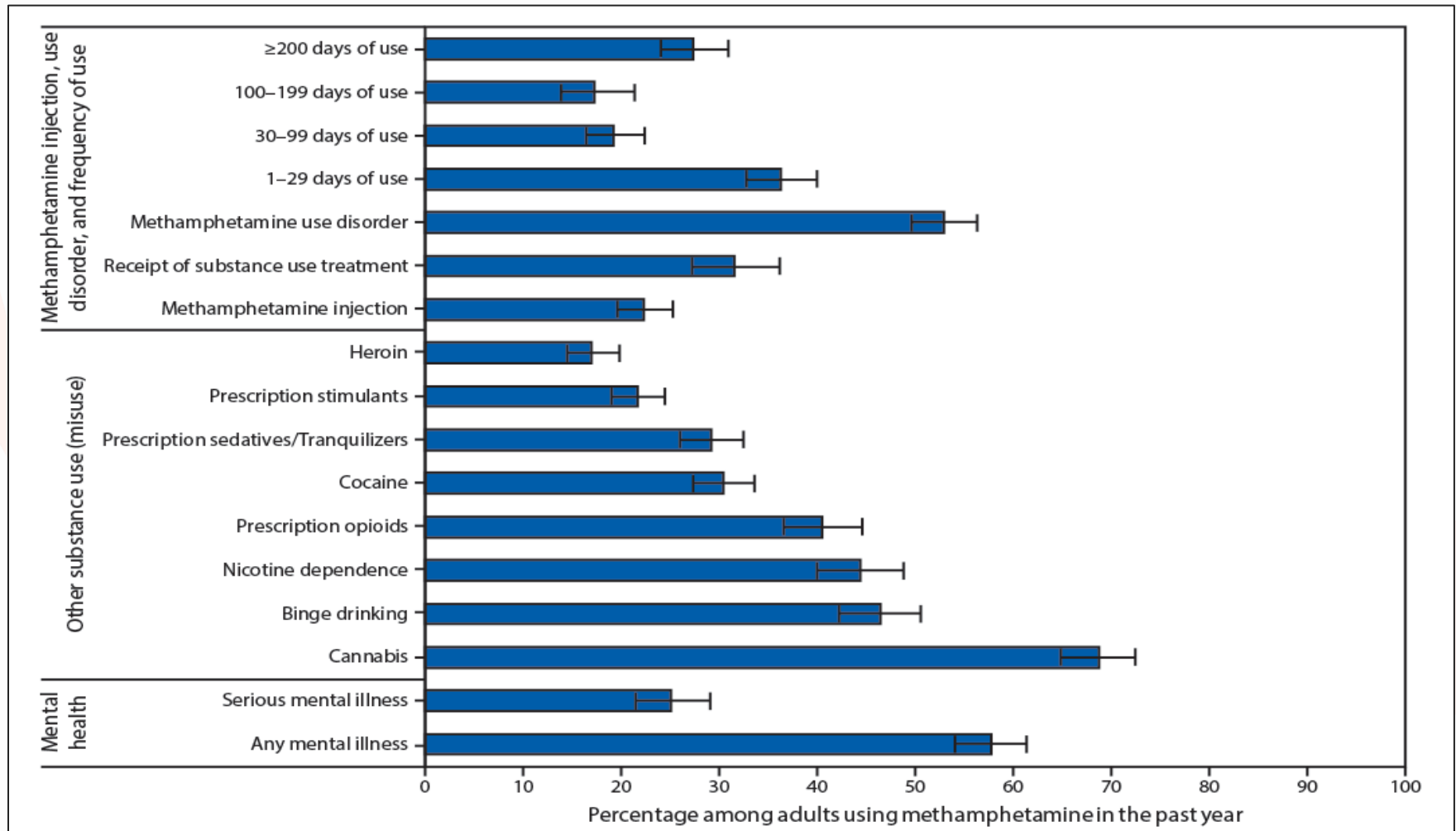
National Mortality Statistics

CDC Data (Wedenoja, 2020)



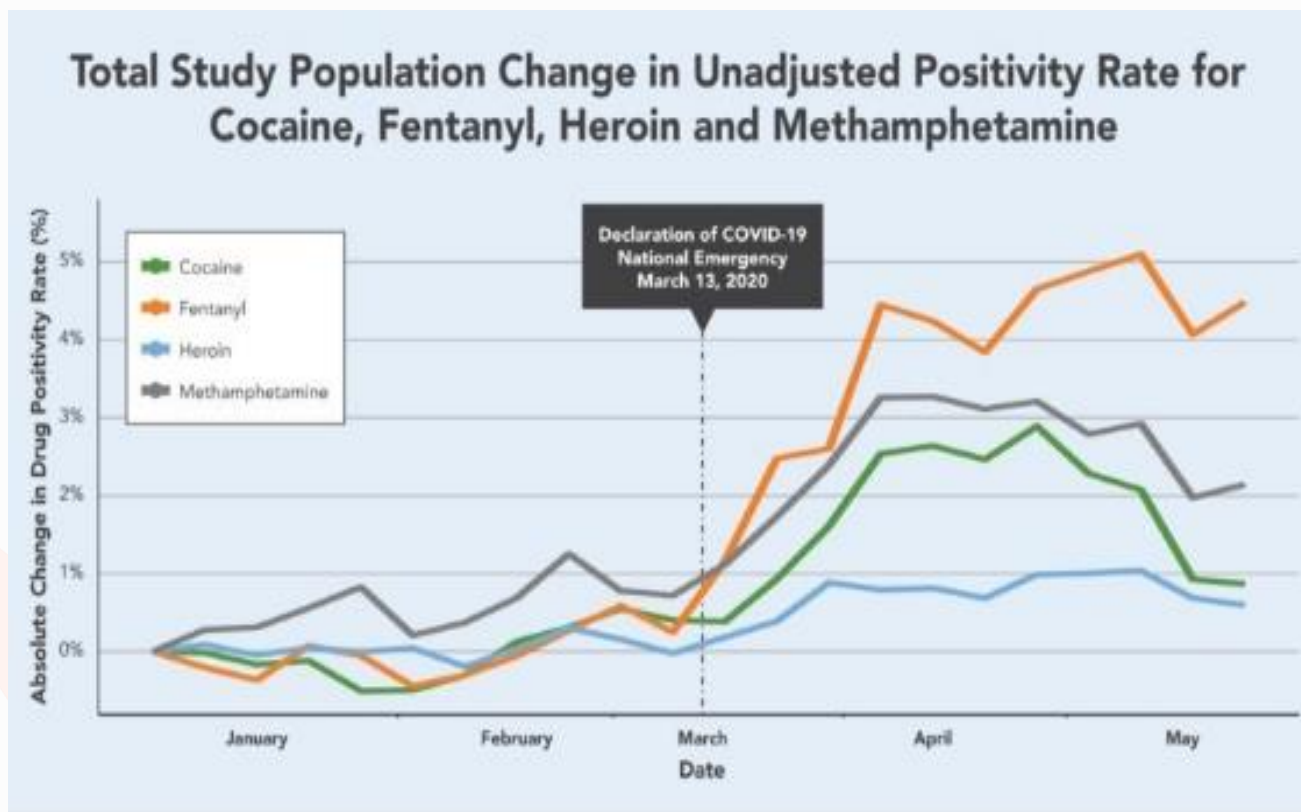
Meth-Related Data for Those ≥ 18 Years Reporting Past-Year Use (2015 – 2018)

Morbidity and Mortality Weekly Report , March 2020



COVID-19 and Substance Use

According to the CDC, as of June 2020, 13% of Americans reported starting or increasing substance use as a way of coping with stress related to COVID-19.

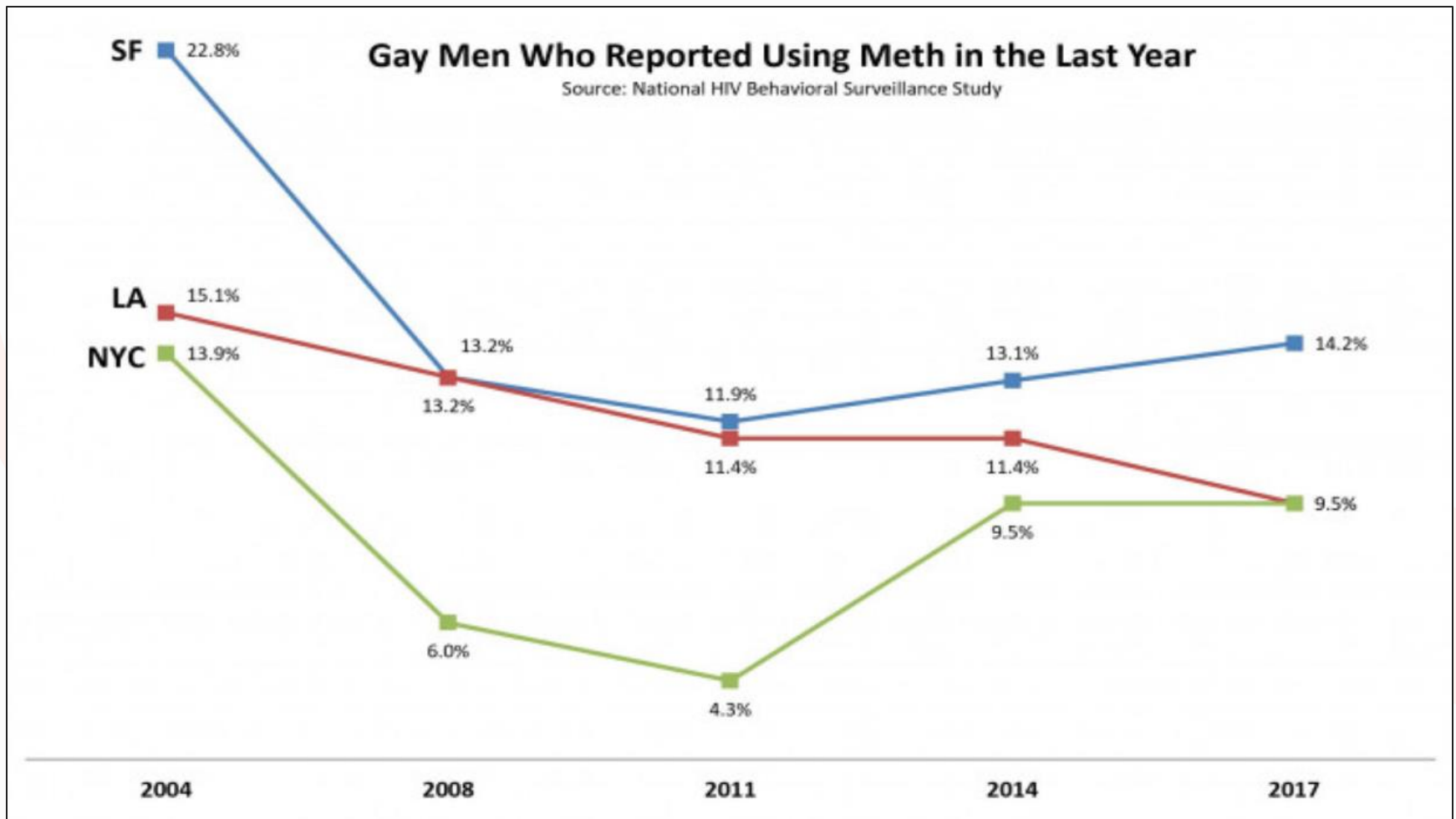


COVID-19 and Substance Use

Press Release from DEA website dated January 26, 2021

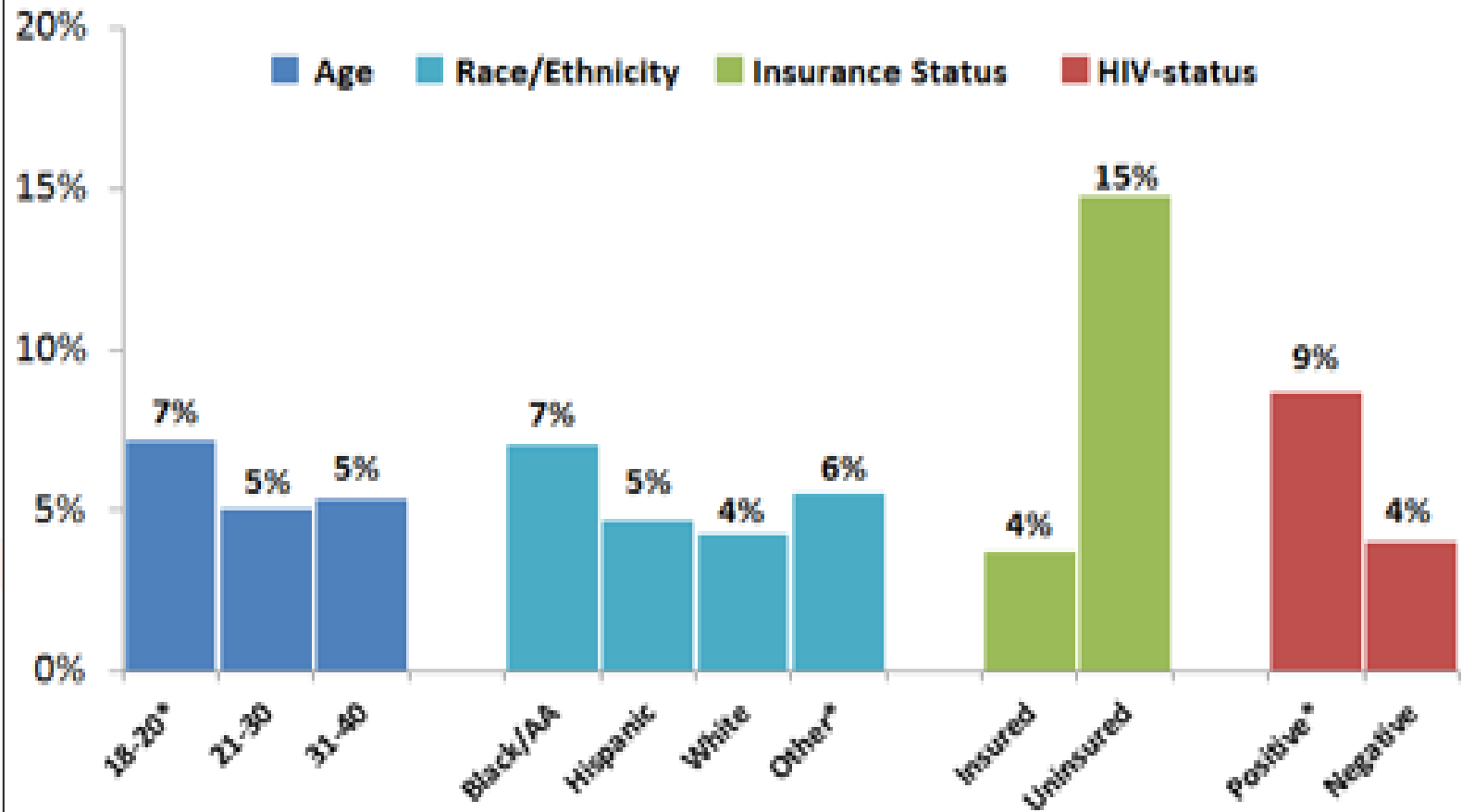
- During 2020, the New York Division of the Drug Enforcement Administration (DEA) seized 214% more Methamphetamine and 59% more Fentanyl as compared to 2019.
- The DEA warns that these increases reflect an increase in use.
- Methamphetamine is second only to Fentanyl in overdose deaths between May 2019 and May 2020.
- Overdose deaths in 2020 are expected to exceed 90,000 – up from 70,630 in 2019.

Prevalence of Methamphetamine Use by Men Who Have Sex with Men (MSM) in San Francisco, Los Angeles & New York City (NYC) 2004-2017



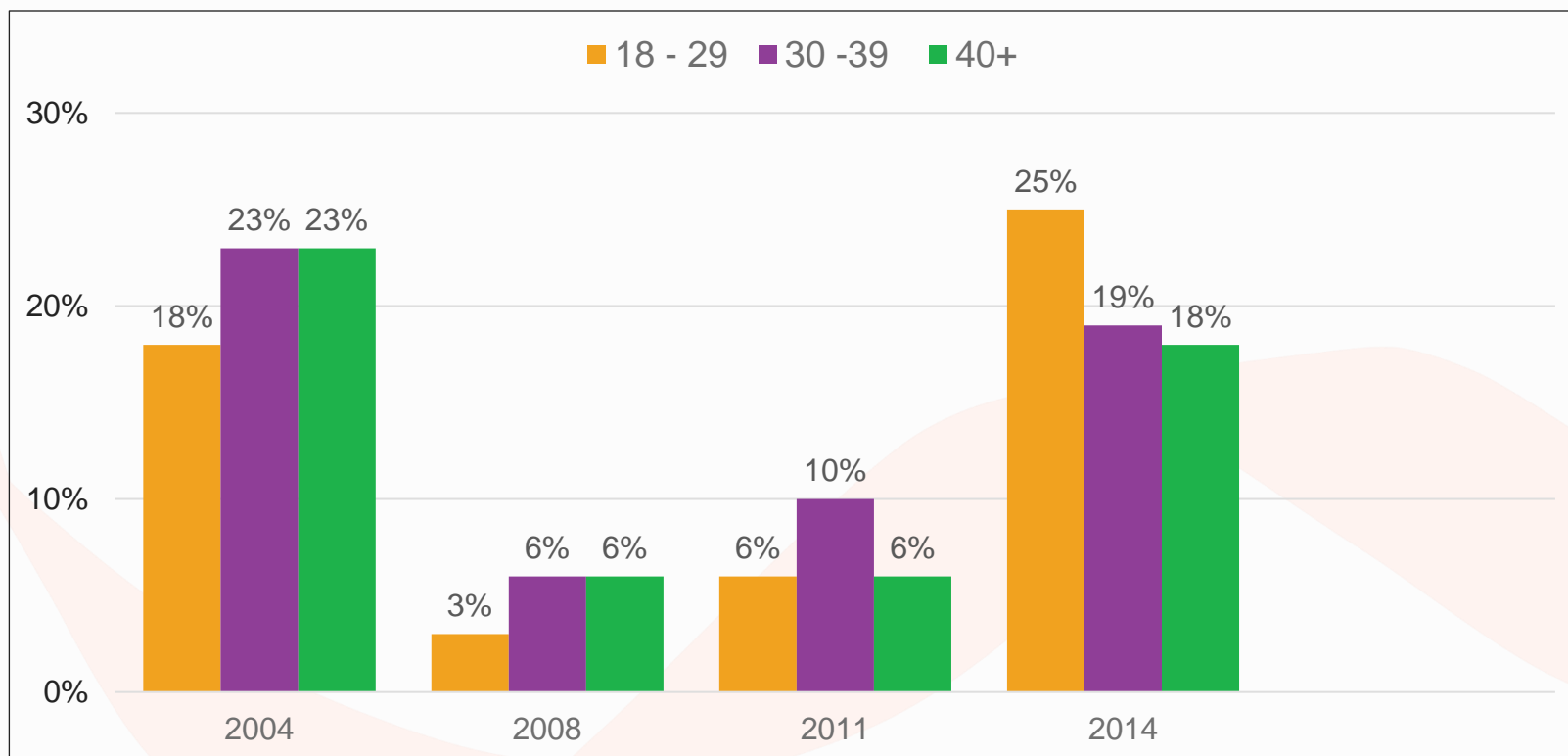
Sexual Health Survey, Spring 2015 (n = 649)

Percentage of MSM in NYC Who Used Meth (past 6 months)



National HIV Behavior Surveillance data

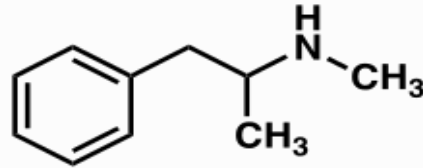
Percent of Participants Who Tested HIV+ and Used Meth (past year)



Crystal Methamphetamine

Street Names:

- Crystal
- Tina
- T
- Glass
- Ice
- Crank
- Meth



Meth Economics

The price of Meth varies greatly by city and state, but it is becoming cheaper and purer.

Term	Amount	Price in NYC
Quarter	1/4 gram (0.01 ounce)	\$40 - \$60
Half	1/2 gram (0.02 ounce)	\$60 - \$100
Gram	1 gram (0.04 ounce)	\$120 - \$200
Teenager	1/16 ounce (1.8 grams)	\$180
8-Ball	1/8 ounce (3.5 grams)	\$350
Ounce	1 ounce	\$1500

Meth vs. Cocaine

Methamphetamine	Cocaine
Man-made	Plant derived
Smoking produces high lasting 8-16 hours	Smoking produces high lasting 8-30 minutes
50% of drug is eliminated from the body in 12 hours	50% of drug is eliminated from the body in 1 hour
Costs about \$120-\$200 per gram	Costs about \$80-\$100per gram

How Methamphetamine is Consumed

In order from fastest to slowest effect:

- Injecting (30 seconds)
- Smoking (30 - 60 seconds)
- Snorting (3 - 5 minutes)
- Swallowing (15 – 20 minutes)



Stages of Methamphetamine Use

CRAVING

- Cues related to use elicit dopamine release, triggering motivation to use.

INTOXICATION

- Meth stimulates large bursts of dopamine that reinforce drug-taking and strengthen associations linking stimuli that precedes drug consumption with the expectation of reward.
- The high lasts 4-12 hours and includes feeling euphoric, self-confident, energetic, and an escape from negative emotions.
- With continued smoking (or injecting), an episode or “binge” can go on for several days.

CRASH

- Withdrawal lasts 1-3 days and includes excessive sleeping, depression, inertia, anhedonia, increased stress and reactivity. Longer exposure exacerbates these responses.

Methamphetamine and Other Substances

- Meth is often used in combination with other substances – Halkitis, Green & Mourgues (2005) assessed substances used during the past 4 months in combination with meth:

Alcohol	64%
MDMA (Ecstasy)	55%
Ketamine	45%
Marijuana	38%
Sildenafil	36%
Inhalant nitrates	34%
Powdered cocaine	33%
GHB (gamma hydroxybutyric acid)	29%
Barbiturates	28%
Crack cocaine	12%
Flunitrazepam (benzodiazepine)	10%
Hallucinogens	9%

Methamphetamine and Other Substances

To enhance the pleasurable effects

- **GHB** or “**G**” (gamma hydroxybutyric acid)
Taken as a liquid, it is a central nervous system depressant that can produce euphoric and hallucinogenic states.
- **Amyl nitrite** (poppers)
Inhaled, produces a brief euphoria, used during sex.
- **MDMA** (Ecstasy/Molly)
Usually taken as a pill or capsule, produces feelings of increased energy, pleasure, emotional warmth.

To counteract the side effects

- **Sildenafil/Tadalafil**
Since Meth can impair erectile function, these drugs are used to compensate for meth-induced impotence.
- **Benzodiazepines** (e.g. Xanax)
After extended use of meth, Xanax is often used to come down and enable sleep.

How Methamphetamine Affects the Brain

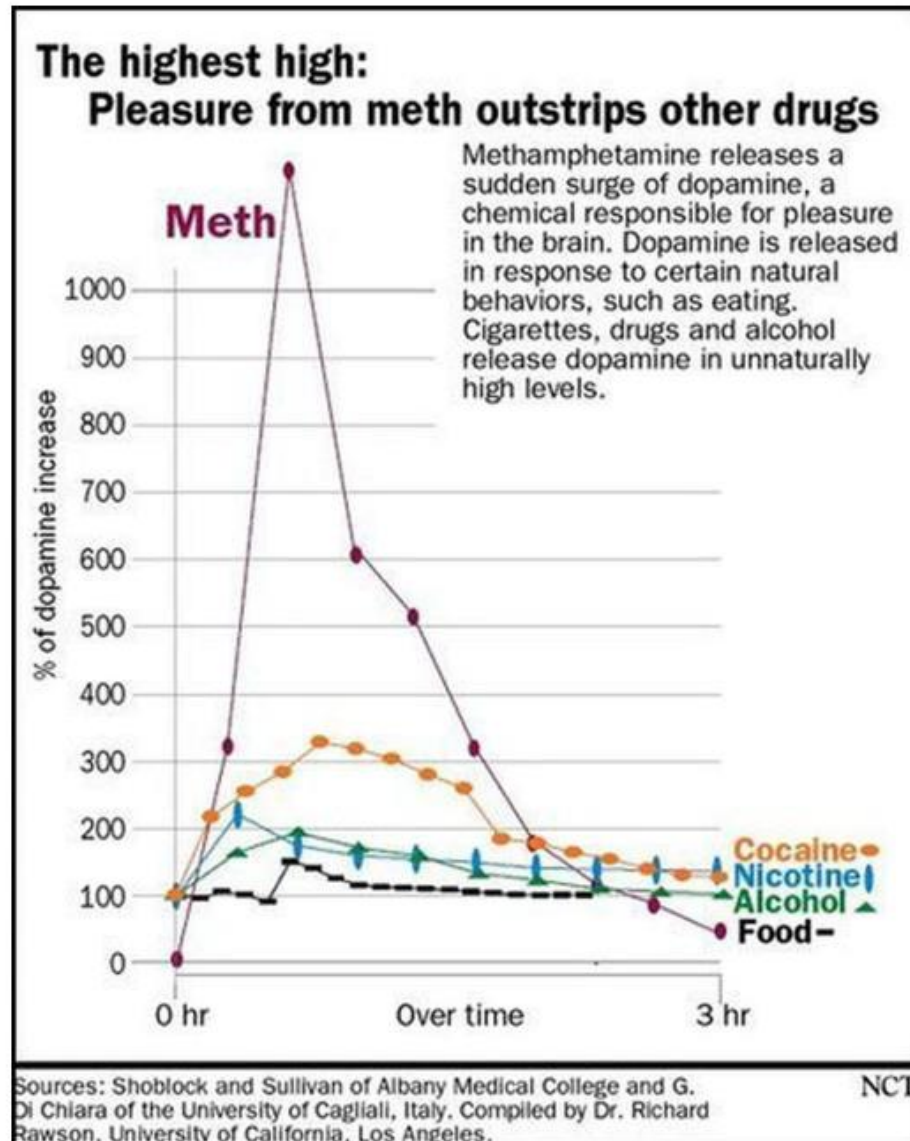
1. Dopamine levels are chronically low in people with addiction to most substances of abuse, including Meth.
2. Meth increases dopamine levels, even during the anticipatory or “urge” phase and then during the “high”.
3. Imaging research indicates that low dopamine levels may occur *before* people become addicted (and therefore might be considered a risk factor for addiction).

How Methamphetamine Affects the Brain

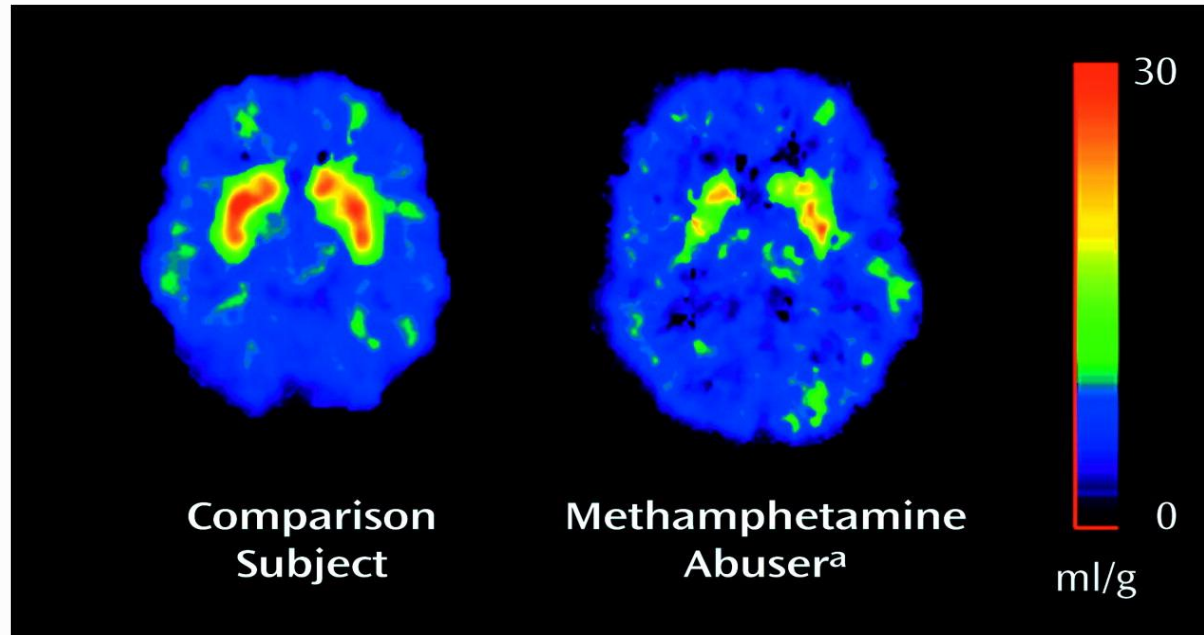
Meth does two things:

1. It stimulates the release of extra dopamine, so the reward pathway is getting very high levels of stimulation.
2. It also prevents neurons from reabsorbing dopamine.
 - Normally, if there is too much dopamine, it would be reabsorbed to help levels get back to normal. Because Crystal Meth stops this from happening, the extra dopamine remains active much longer.
 - These two factors exaggerate the normal actions of dopamine and is why meth produces a profound feeling of euphoria and well-being.

Dopamine Levels After Food, Alcohol, Nicotine, Cocaine & Meth



Long-term Effects of Methamphetamine on the Brain

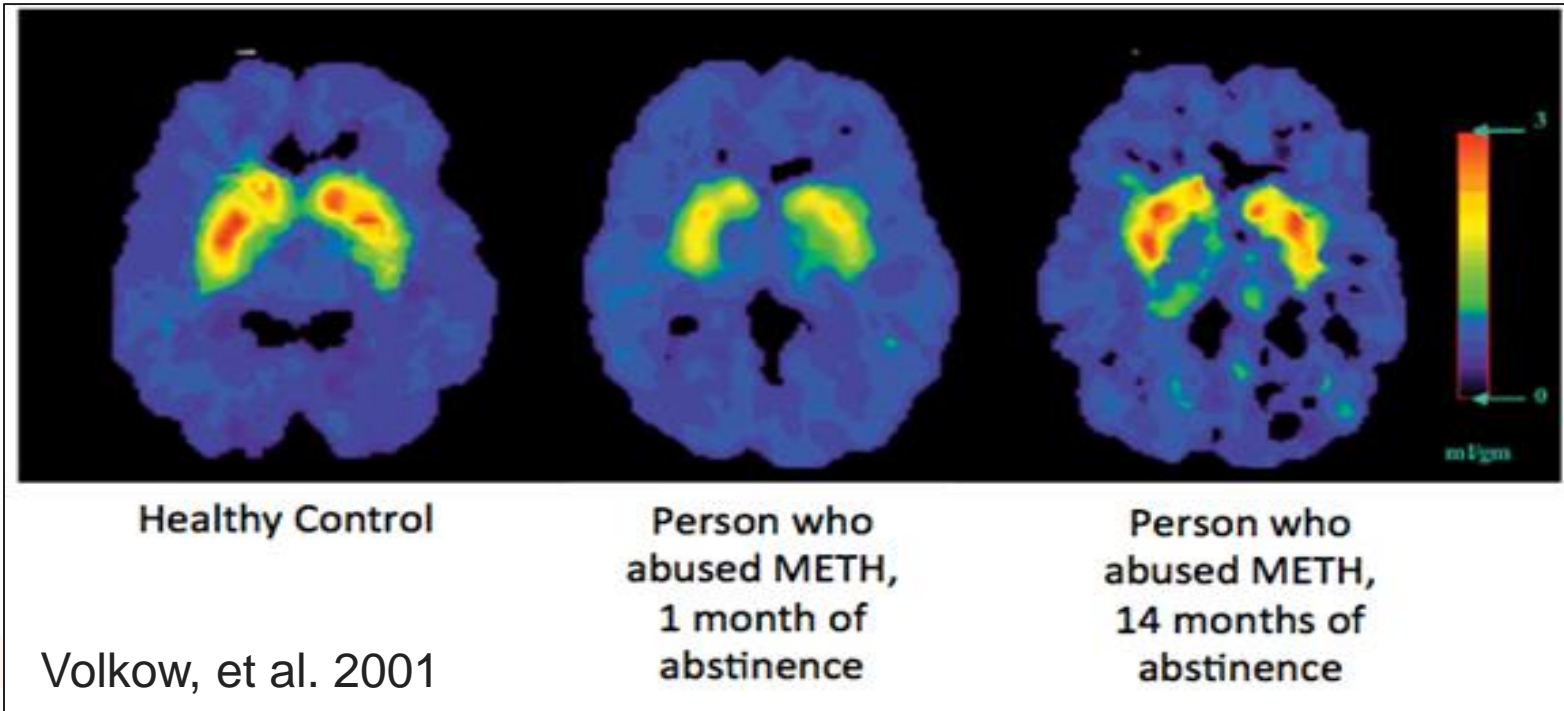


Volkow, et al. 2001

Loss of dopamine neurons after heavy Meth use may occur.

As many as 50% of the dopamine producing cells in the brain can be damaged after prolonged exposure to Meth.

Recovery of the Brain After Abstinence



These changes are reversible over time, but probably contribute to why recovery is so difficult.

Patterns of use for Gay Men

Frequency of Use	Context of Use
Occasional party, special event	Dancing at circuit parties or clubs
Monthly – Weekend user	Sexual encounters with groups or individuals met on-line and meeting up at apartments or hotel rooms
Nearly daily - Daily user	At home – often uses alone

Short-Term Effects of Meth

Psychological

- Increases mood
- Increases confidence
- More talkative
- Heightened sex drive

Social

- More social
- Increase desire to go out
- Sense of belonging

Physical

- Fight or flight response
- High energy
- Decrease in appetite
- Insomnia

Long-Term Effects of Meth

Psychological

- Anxiety
- Depression
- Suspiciousness or paranoia
- Hallucinations
- Irritability

Social

- Social withdrawal
- Relationship issues
- Loss of employment
- Financial problems

Physical

- Dental problems (due to dry mouth)
- Weight loss
- Intense itching (sores)
- Infections, STDs

Lust, Men and Meth – David Fawcett, 2016

Meth's appeal for gay men:

- Escape uncomfortable feelings
 - Shame, stigma, fear, guilt
- Heightens sexual experiences by enhancing desire and duration
- Increases confidence and assertiveness
- Creates a sense of worth and belonging
- Reduces feelings of isolation by creating feelings of connection

Lust, Men and Meth – David Fawcett. 2016

1. The sex-enhancing properties of Meth facilitates a connection in the brain between the drug and an intense sexual experience.
2. The dopamine response creates a strong connection between sex and the Meth use.
3. Over time, sex and Meth become inseparable – “What fires together wires together”.
4. Some people who abuse Meth will state that they can’t have sex without it.
5. Sexual desire/behavior can become obsessive.
6. Sex triggers the desire to use Meth, and Meth triggers the desire for sex.

Lust, Men and Meth – David Fawcett, 2016

- Hook up sites facilitate fast, easy connections with other men looking for sexual hook ups involving meth
- For example: Grindr, Scruff, Jack'd, GROWLr, BBRT (Bareback real time)



- Messages might include coded language to request a hook up involving meth:
 - “Party and Play”, PNP
 - “parTy”
 - Capital ‘T’ in the headline

Lust, Men and Meth – David Fawcett, 2016

Meth's impact on sexual behavior:

- Reduced inhibitions and impulse control - fantasies become real behavior.
- Indiscriminate sex partners – sex with more people including strangers.
- Rougher and kinkier sex, pushing personal limits.

Meth's impact on performance:

- Long “sex marathons” lasting for hours or days
- Erectile dysfunction (“crystal D”)

Meth and HIV

Consequences for HIV+ MSMs who use meth:

- Antiretroviral medication Non-adherence
- Higher viral load

Consequences for HIV- MSMs who use meth:

- HIV seroconversion
- Other STDs

Public Health Consequences:

- Increased prevalence of HIV and STDs

Recovery from Meth Use

- Long, difficult process
- Lapses or relapses are common
- Depression and hopelessness
- The brain needs time to heal
- Other addictions (sex, alcohol) need to be addressed

Recovery from Meth Use (cont.)

- Grieve the loss of Meth and Chem sex and let it go
- Delete hook up apps
- Abstain from sex
- Change phone number
- Reconnect with old social networks to create a sense of belonging

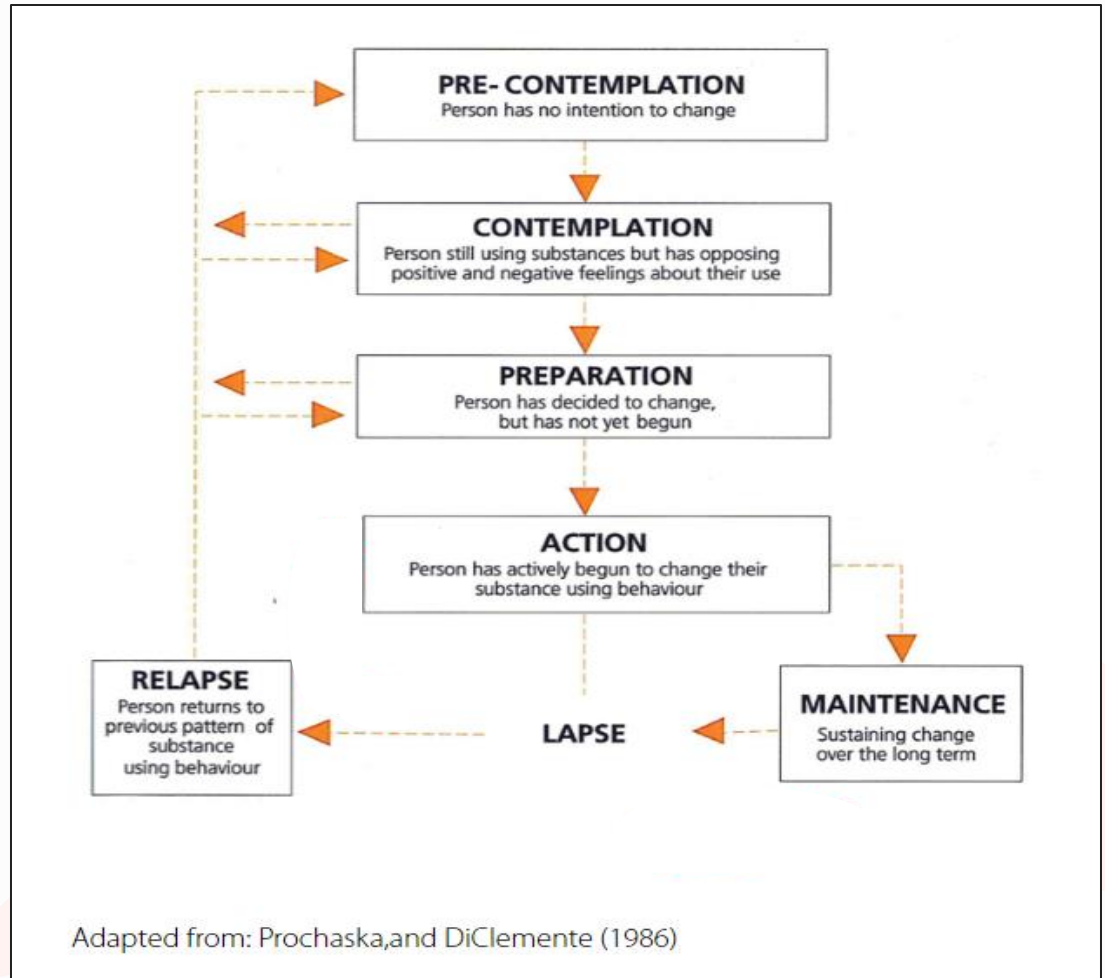
Recovery from Meth Use (cont.)

- Join support groups
- Consider psychotherapy

Assessing Readiness to Reduce/Quit Use

Prochaska and DiClemente's
Trans-Theoretical Model of
Change

Ask the patient to discuss the
PRO's and CON's of use



Behavioral Treatments for Meth

Cognitive Behavioral Therapy (CBT)

- Based on the principles of conditioning and learning, focuses on relapse prevention skills including identifying triggers, strategies to reduce cravings, and engagement in non-drug activities.

Contingency Management (CM)

- Based on the principles of positive reinforcement, offers tangible rewards (money or vouchers) contingent upon desired behavior (e.g. clinic attendance, drug-free urine).

Matrix Model

- 16-week outpatient program that integrates several treatment strategies including individual and family counseling, group therapy, plus 12-step meetings.

Research Comparing Behavioral Treatments for Meth

Lee and Rawson (2008), in a review of randomized trials comparing the different types of psychological treatments, conclude:

- Any of the behavioral interventions appear to be better than control conditions (often supportive counseling).
- It is difficult to compare studies using behavioral interventions because the intervention itself is rarely described.
- Although CBT and CM are accepted as standard treatments for meth abuse, both have high rates of dropouts during the first month and a >50% relapse rate 6-19 months after treatment ends.
- Behavioral interventions might prove to be most effective **in combination** with medication.

Treatment of Methamphetamine Use

Several medications have been tested in randomized, placebo-controlled trials (usually with behavioral component):

Modafinil

Bupropion

Naltrexone

Mirtazapine

Bupropion + Naltrexone

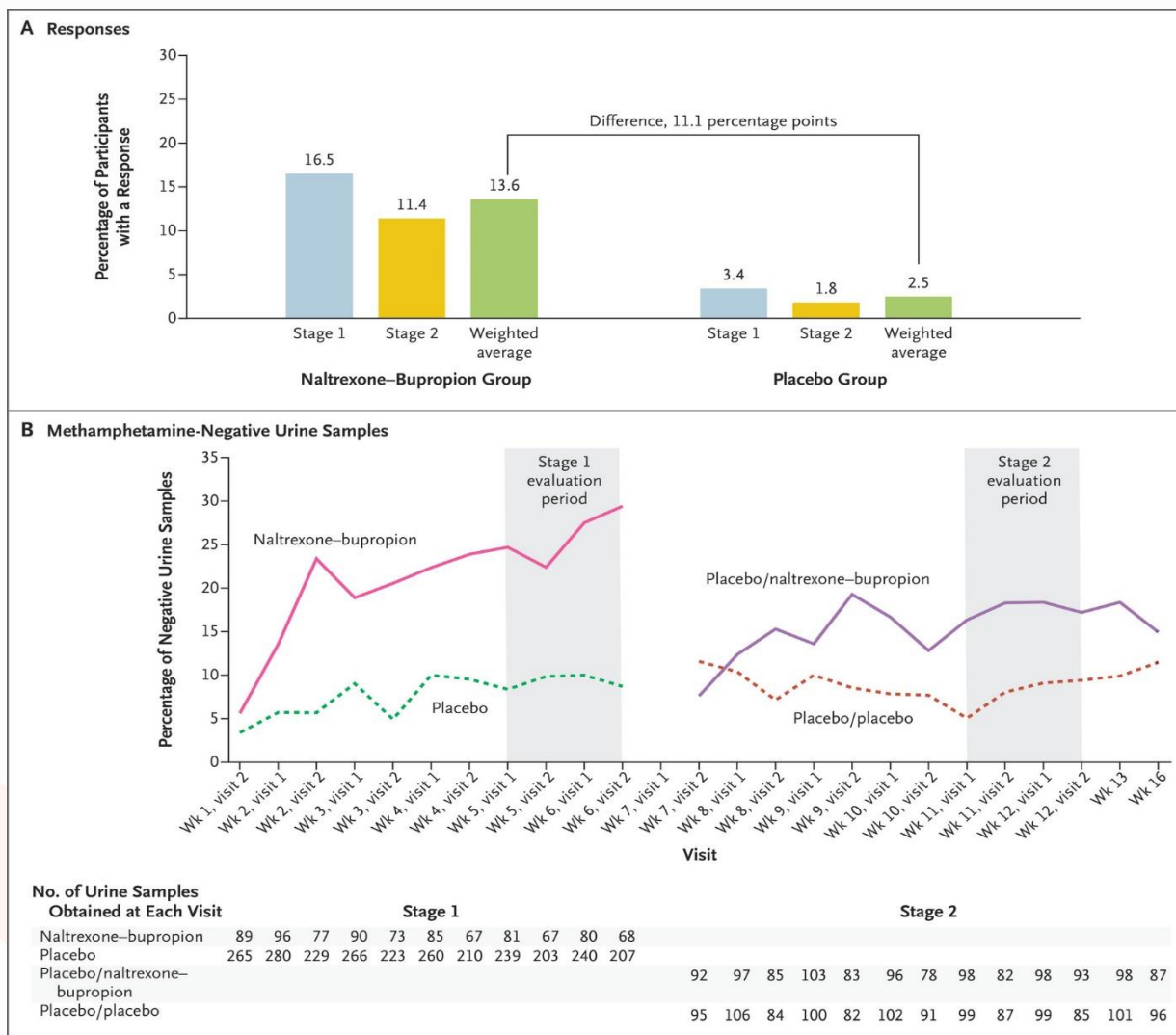
Other substances:

Ibudilast

Ibogaine

Bupropion + Naltrexone for Treatment of Meth Use (n = 403)

Trivedi, et al. (2021)



Treatment Options

12-step groups:

- Crystal Meth Anonymous (CMA)
- Narcotics Anonymous (NA)
- Alcoholics Anonymous (AA)
- SMART Recovery

Intensive Outpatient programs:

- Abstinence Model (urine toxicology testing)
- Harm-Reduction model

Inpatient Programs:

- Recommend 3+ months, although Medicaid often limits to 2 weeks
- After discharge: linkage to treatment maintenance is essential

References

- Anthony J, Warner L, Kessler R. Comparative epidemiology of dependence on alcohol, controlled substances and inhalants: Basic findings from the National Comorbidity Survey. *Experimental and Clinical Psychopharmacology*; 1994; 2:244-268.
- Dean A, Groman S, Morales A et al. An evaluation of the evidence that methamphetamine abuse causes cognitive decline in humans. *Neuropsychopharmacology*. 2013; 38:259-274.
- Dotinga R. Methamphetamine use climbing among opioid users. *Clinical Psychiatry News*, June 29, 2018.
- Fawcett, D. (2016). *Lust, Men and Meth: A Gay Man's Guide to Sex and Recovery*. Healing Path Press, Wilton Manors, FL.
- Halkitis, P. N., Fischgrund, B. N., & Parsons, J. T. (2005). Explanations for methamphetamine use among gay and bisexual men in New York City. *Substance use & misuse*, 40(9-10), 1331-1345.
- Han, B., Compton, W. M., Jones, C. M., Einstein, E. B., & Volkow, N. D. (2021). Methamphetamine use, methamphetamine use disorder, and associated overdose deaths among US adults. *JAMA psychiatry*.
- Hart C, Marvin C, Silver R et al. Is cognitive functioning impaired in methamphetamine users? A critical review. *Neuropsychopharmacology*. 2012; 37:586-608.

References

- Johanson, C. E., Frey, K. A., Lundahl, L. H., Keenan, P., Lockhart, N., Roll, J., ... & Schuster, C. R. (2006). Cognitive function and nigrostriatal markers in abstinent methamphetamine abusers. *Psychopharmacology*, 185(3), 327-338.
- Kalechstein, A. D., Newton, T. F., & Green, M. (2003). Methamphetamine dependence is associated with neurocognitive impairment in the initial phases of abstinence. *The Journal of neuropsychiatry and clinical neurosciences*, 15(2), 215-220.
- McCann, U. D., Wong, D. F., Yokoi, F., Villemagne, V., Dannals, R. F., & Ricaurte, G. A. (1998). Reduced striatal dopamine transporter density in abstinent methamphetamine and methcathinone users: evidence from positron emission tomography studies with [11C] WIN-35,428. *Journal of Neuroscience*, 18(20), 8417-8422.
- Scholl L, Seth P, Kariisa M, Wilson N, Baldwin G. Drug and Opioid-Involved Overdose Deaths – United States, (2013-2017). *WR Morb Mortal Wkly Rep*.
- Simon, S. L., Domier, C. P., Sim, T., Richardson, K., Rawson, R. A., & Ling, W. (2001). Cognitive performance of current methamphetamine and cocaine abusers. *Journal of addictive diseases*, 21(1), 61-74.
- Trivedi MH, Walker R, Ling W, dela Cruz A, Sharma G, Carmody T, et al.(2021) Bupropion and naltrexone in methamphetamine use disorder. *New England Journal of Medicine*, 384(2):140–53.
- Volkow, N, Chang, L, Wang, G, Fowler, J, Franceschi, D, Sedler, M, et al (2001) Loss of dopamine transporters in methamphetamine abusers reovers with protracted abstinence. *J Neurosci* 21:9414-9418.
- Volkow N, Boyle M. Neuroscience of addiction: Relevance to prevention and treatment. *Am J Psychiatry*. 2018; 175(8):729-740.

CDC Data
(Wedenoja, 2020)

	Abstinence	Use	Retention	Harms
All Antidepressants	★★	∅	★★	★
Aminoketone: Bupropion	★	★	★★	∅
Atypical Antidepressant: Mirtazapine	NA	∅	∅	∅
SSRI: Sertraline	∅	NA	∅	NA
Atypical Antipsychotics: Aripiprazole	∅	★	∅	∅
Psychostimulants and Other Medications for ADHD				
All Psychostimulants: Modafinil, Dexamphetamine, Methylphenidate	★	∅	★	NA
Methylphenidate	NA	★	★	NA
Atomoxetine	NA	∅	∅	∅
All Anticonvulsant and Muscle Relaxants: Baclofen, Gabapentin, Topiramate	∅	∅	∅	∅
Topiramate	NA	★	★	★
Medications used for other substance use disorders				
Naltrexone	∅	★	★	★★
Varenicline	NA	∅	∅	∅

Shading represents the direction of effect:

(No color)	Unclear
Grey	No difference
Green	Evidence of benefit
Red	Favors placebo

Symbols represent the strength of the evidence:

NA	No evidence or not applicable
∅	Insufficient
★	Low
★★	Moderate
★★★	High

Chan 2019

<https://pubmed.ncbi.nlm.nih.gov/31328345/>