

Stimulant Use: Current Trends, Impact on the Brain and Body, and Implications for Treatment



ATTC

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

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Disclosures



No relevant financial relationships with commercial interests exist for anyone who is in control of the content of this activity.

Special Thanks



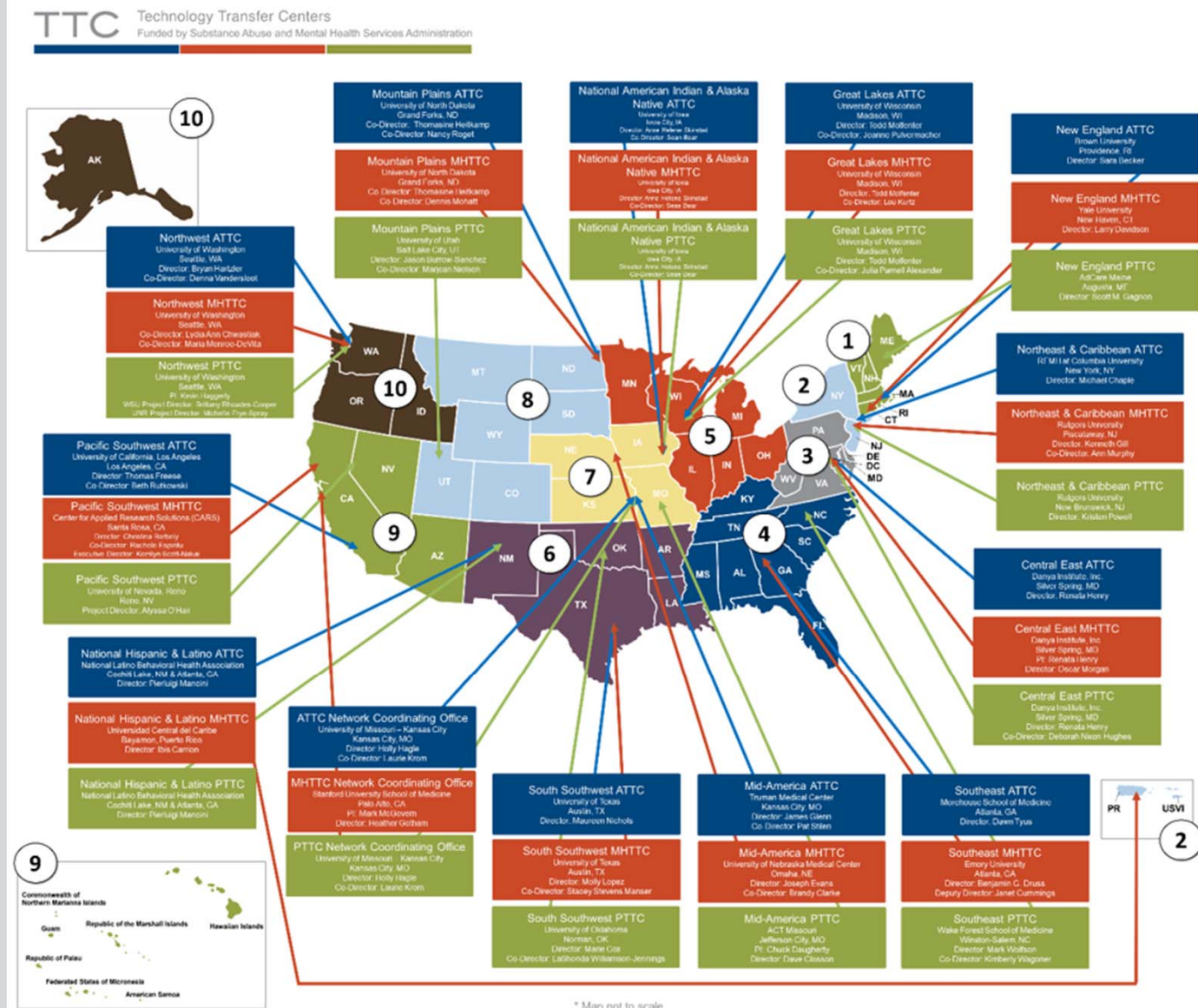
- Jessica Samuel, IRETA
- ATTC Stimulant Workgroup

About the ATTC Network



- **The ATTC Network is an international, multidisciplinary resource for professionals in the addictions treatment and recovery services field.**
- Established in 1993 by the Substance Abuse and Mental Health Services Administration (SAMHSA), the ATTC Network is comprised of 10 U.S.-based Centers, 2 National Focus Area Centers, and a Network Coordinating Office.
- Together the Network serves the 50 U.S. states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and the Pacific Islands of Guam, American Samoa, Palau, the Marshall Islands, Micronesia, and the Northern Mariana Islands.

The U.S.-Based TTC Network



Educational Objectives



At the end of this keynote presentation, participants will be able to:

1. Identify three specific national patterns and trends in stimulant use.
2. Recall at least three short-term and three long-term physical or psychological effects of stimulant use.
3. Apply at least two specific behavioral treatment interventions and two recovery approaches that have been proven effective in treating people with a stimulant use disorder.

The Scope of Stimulant Use in the United States and Beyond



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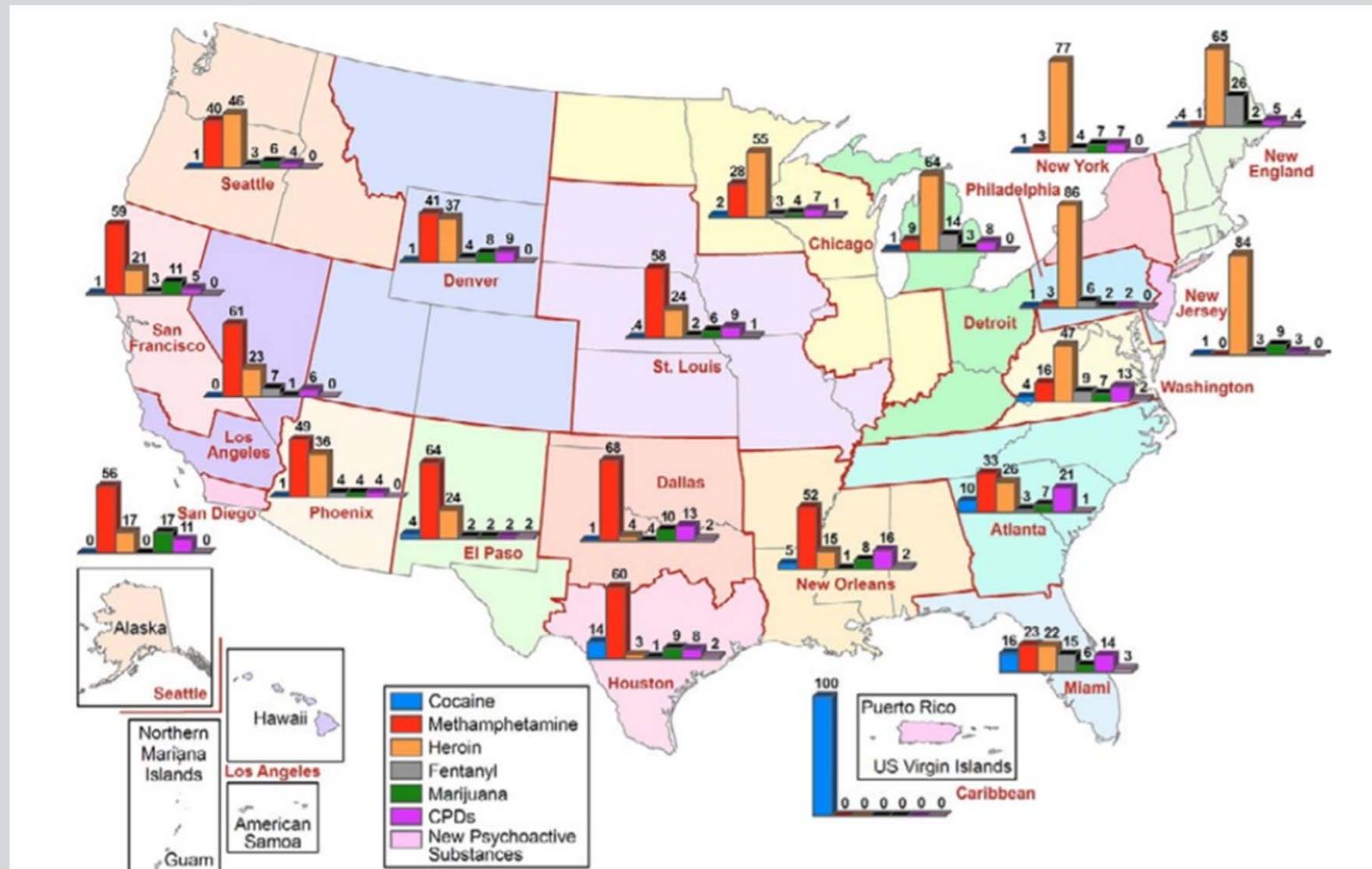
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What we know...globally



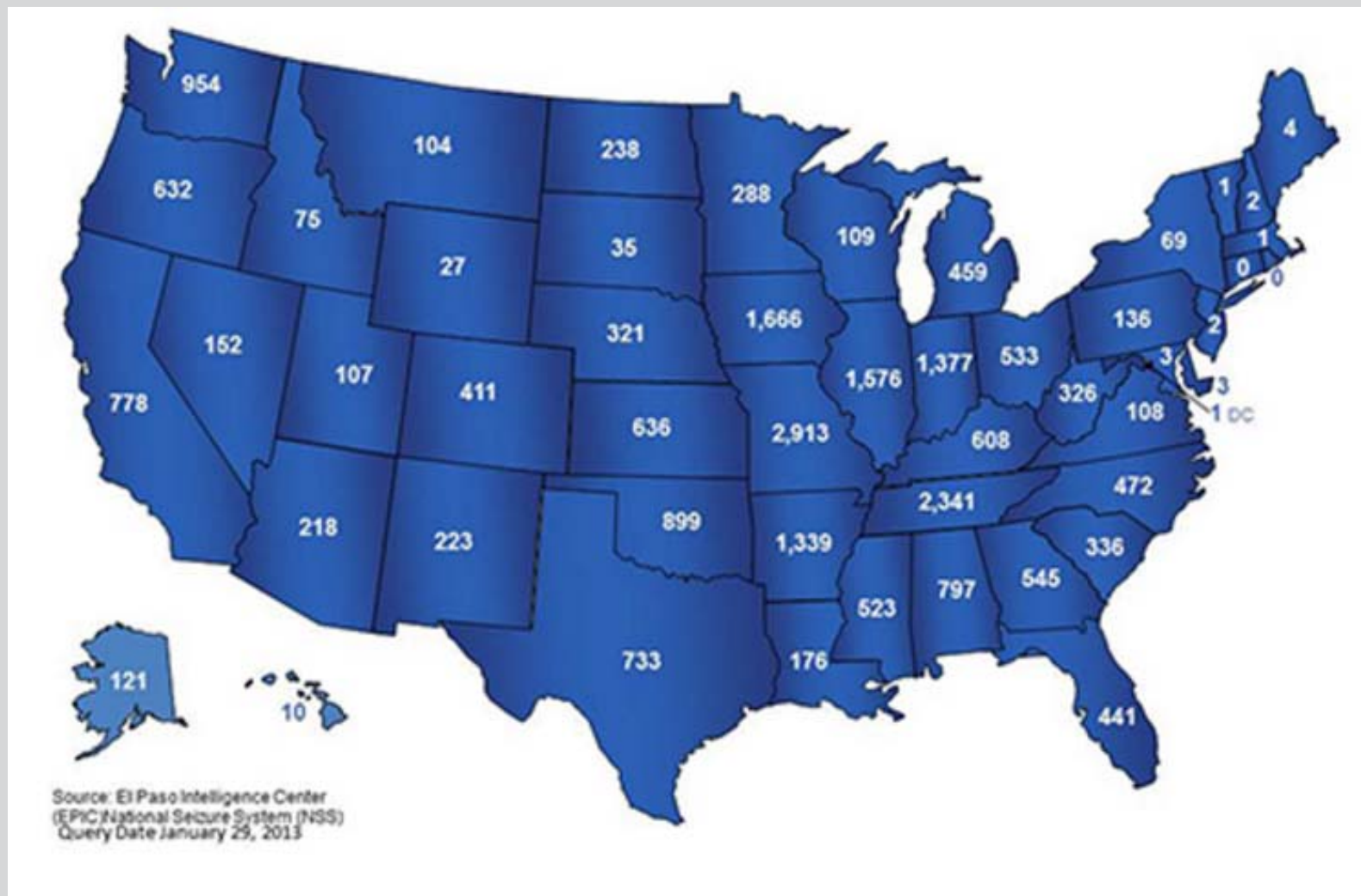
- Amphetamine-type stimulants (ATS) constitute the 3rd most widely used illicit drug category in the world, following cannabis and opioids
- The type of ATS used varies by region
 - Amphetamines in Europe and the Middle East
 - Methamphetamine in the US, Australia, and SE Asia
- Different precursors used in the manufacturing process

Greatest Drug Threat by Field Division as Reported by State and Local Agencies: 2017



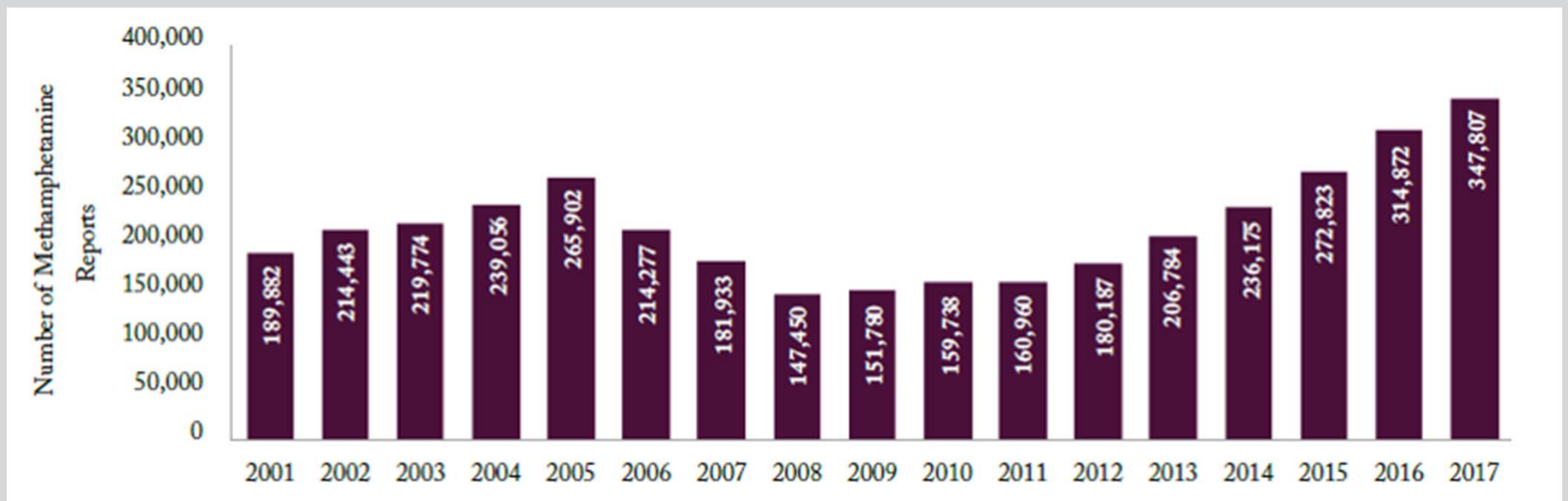
SOURCE: U.S. DEA, 2017

U.S. Methamphetamine Lab Incidents: 2004 vs. 2017



SOURCE: U.S. DEA, 2017

Methamphetamine Reports have Increased Nationally, NFLIS, 2001-2017



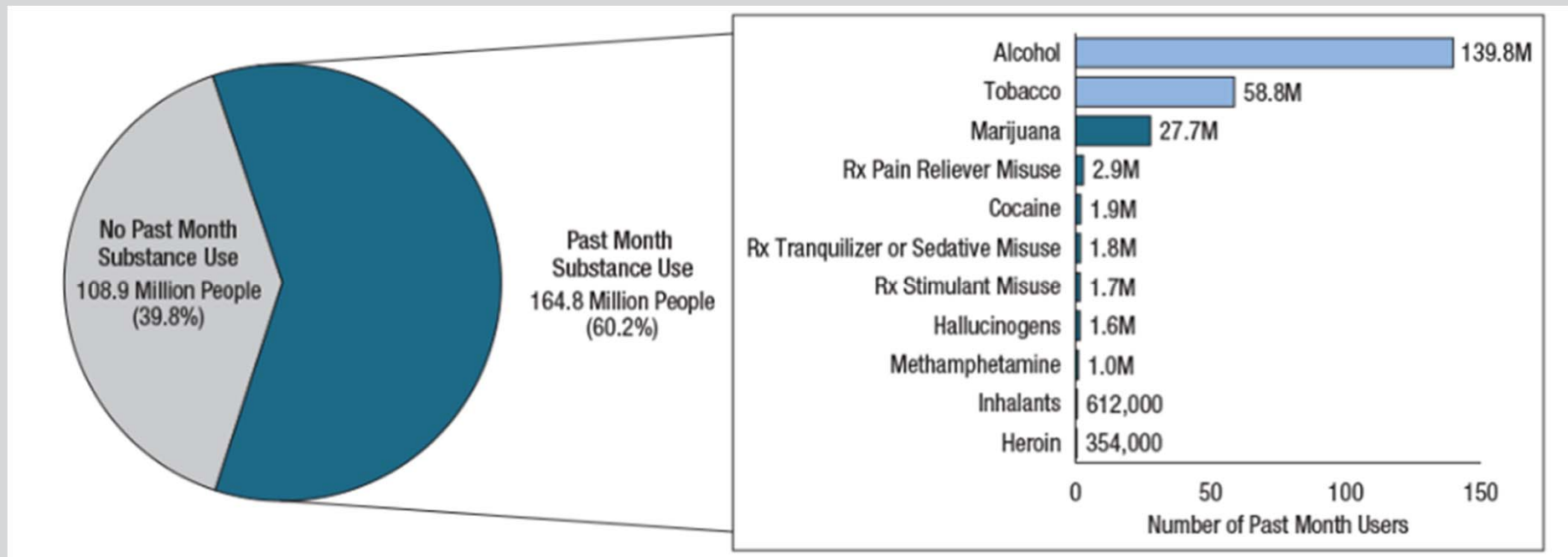
SOURCE: U.S. DEA, 2019

Top Drug Offenses, by State



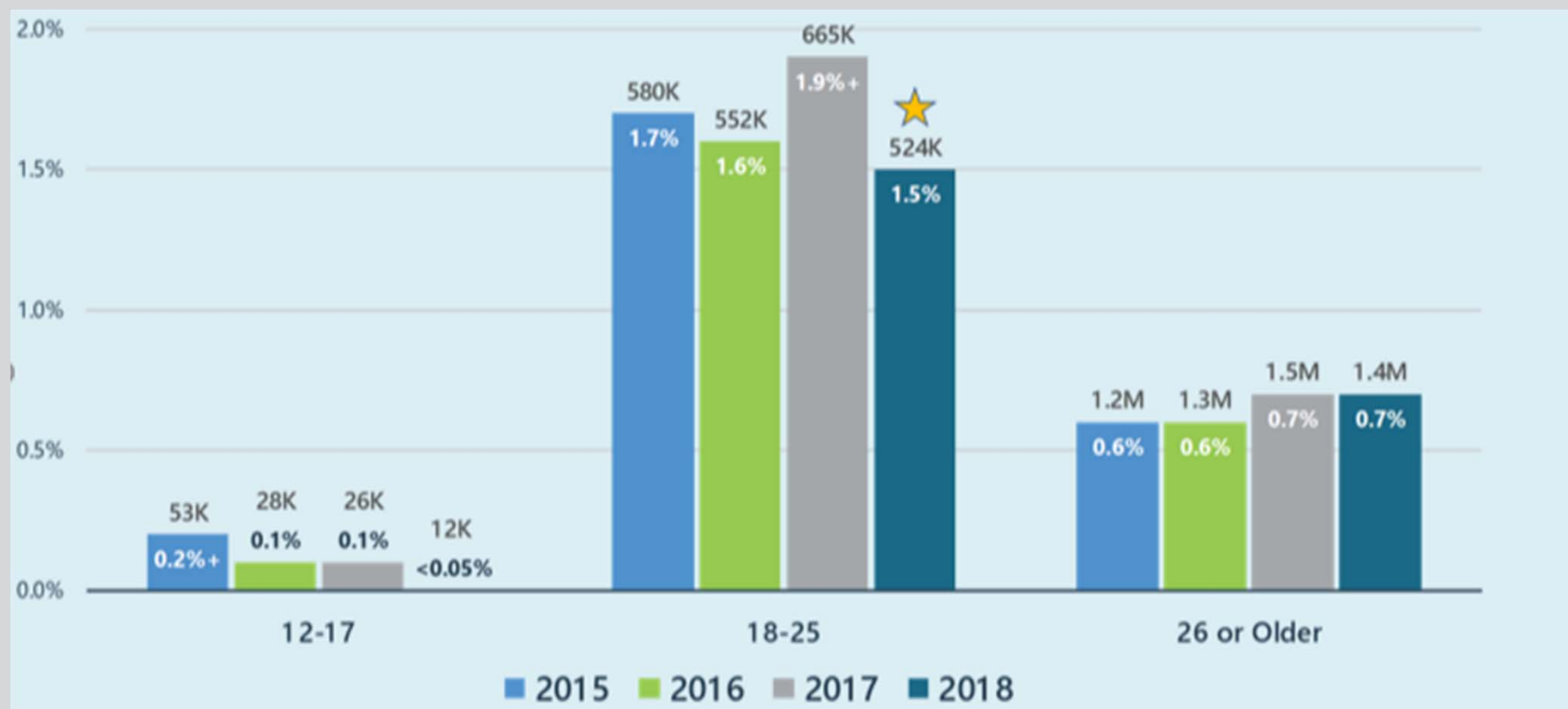
SOURCE: Abadi, 2016

Numbers of People Reporting Past Month Substance Use among those Aged 12 or Older: 2018



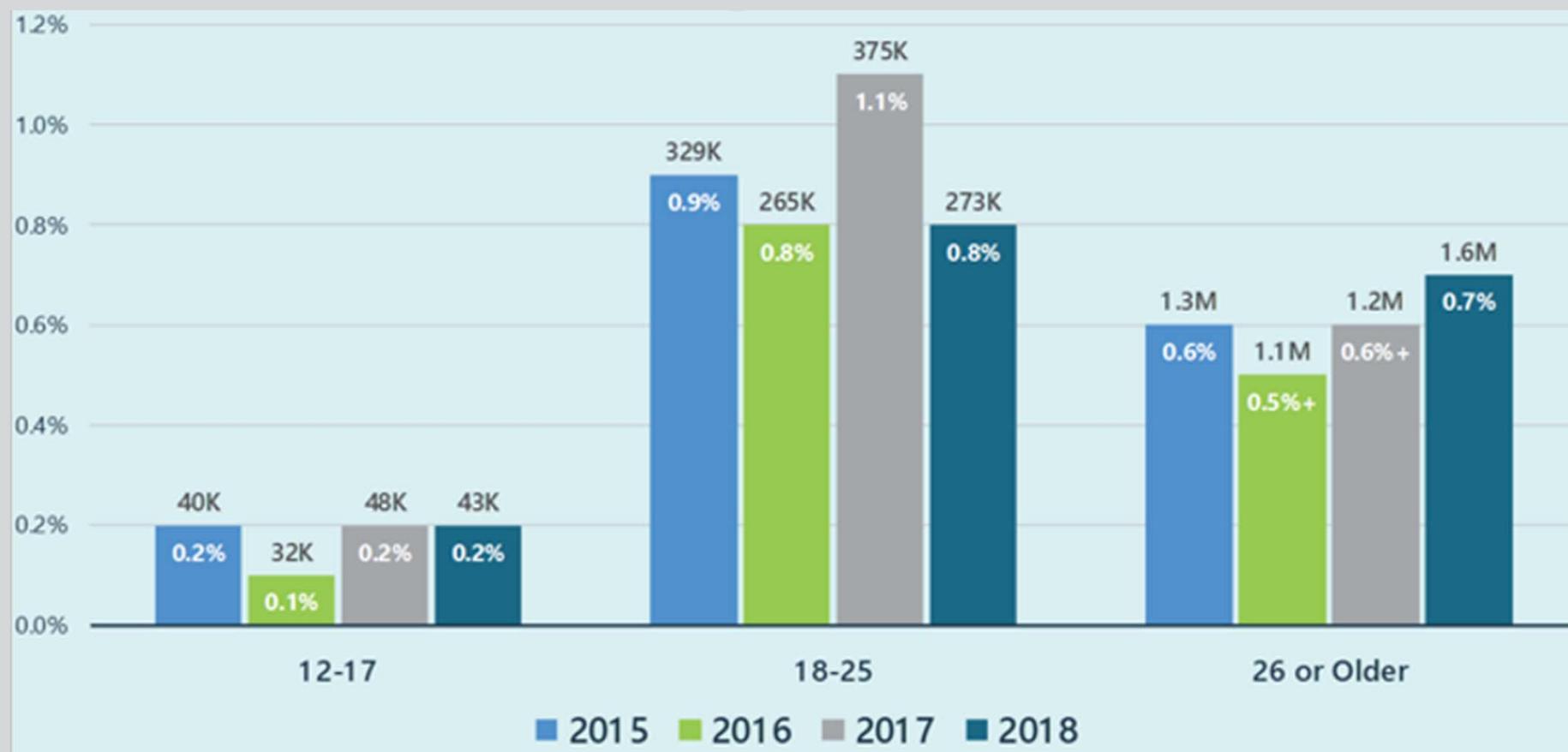
SOURCES: McCance-Katz, 2019; SAMHSA, 2019

Trends in Past Year Use of Cocaine: Significant Decrease in Young Adults (18-25)



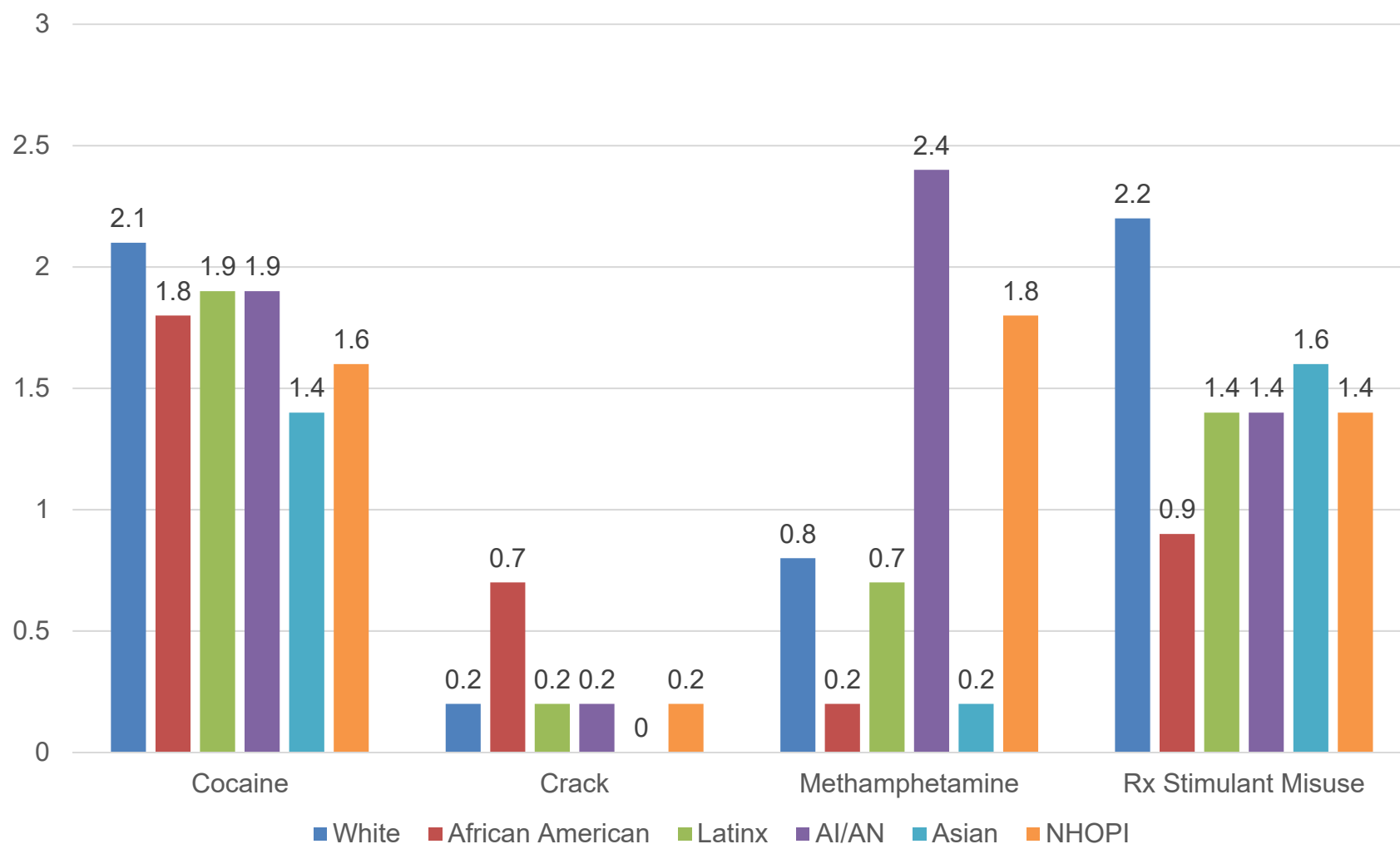
SOURCES: McCance-Katz, 2019; SAMHSA, 2019

Trends in Past Year Use of Methamphetamine: Significant Increase in Adults 26+ Years Old



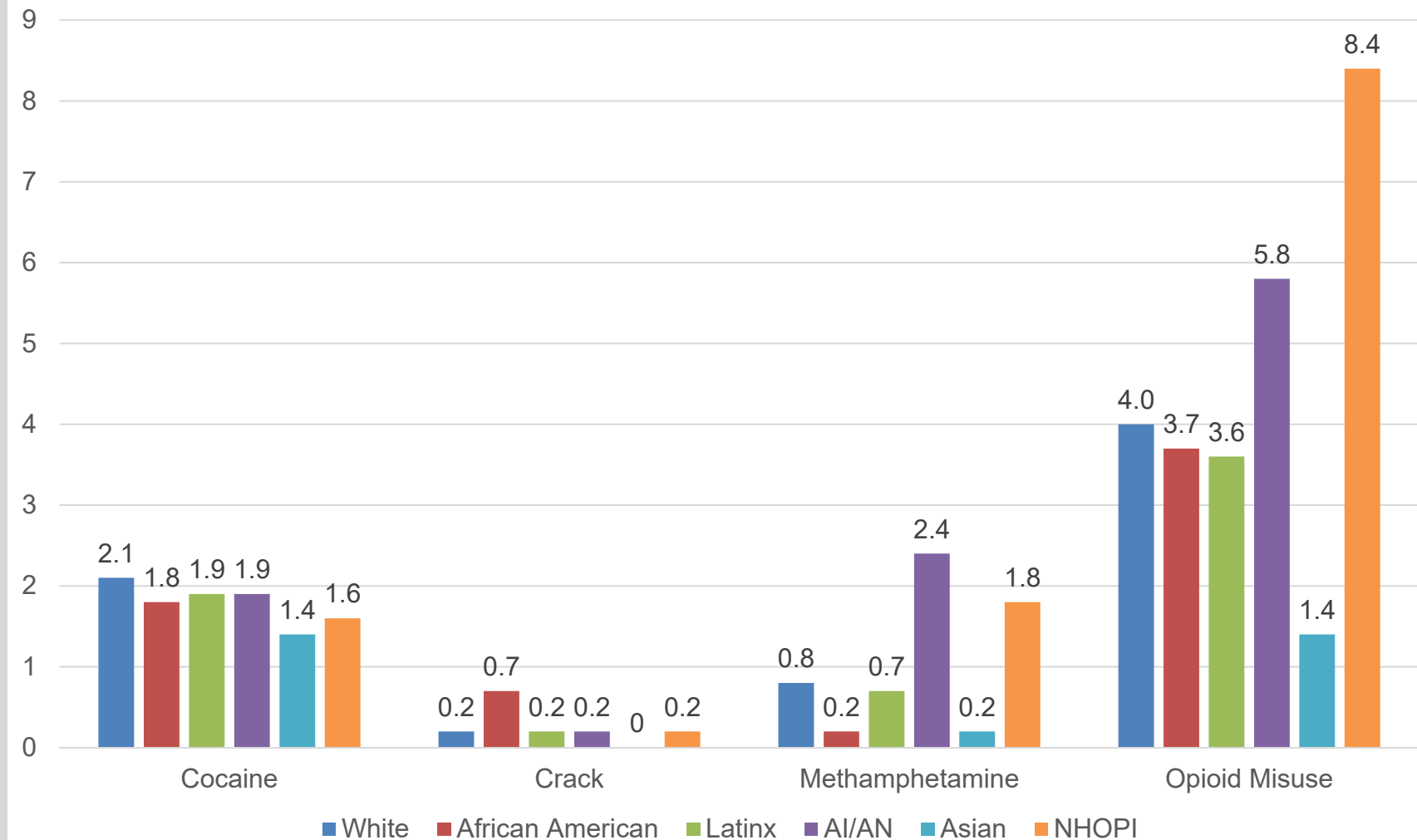
SOURCES: McCance-Katz, 2019; SAMHSA, 2019

Past Year Use (as Percentages) of Stimulants by Racial/Ethnic Group, 2018



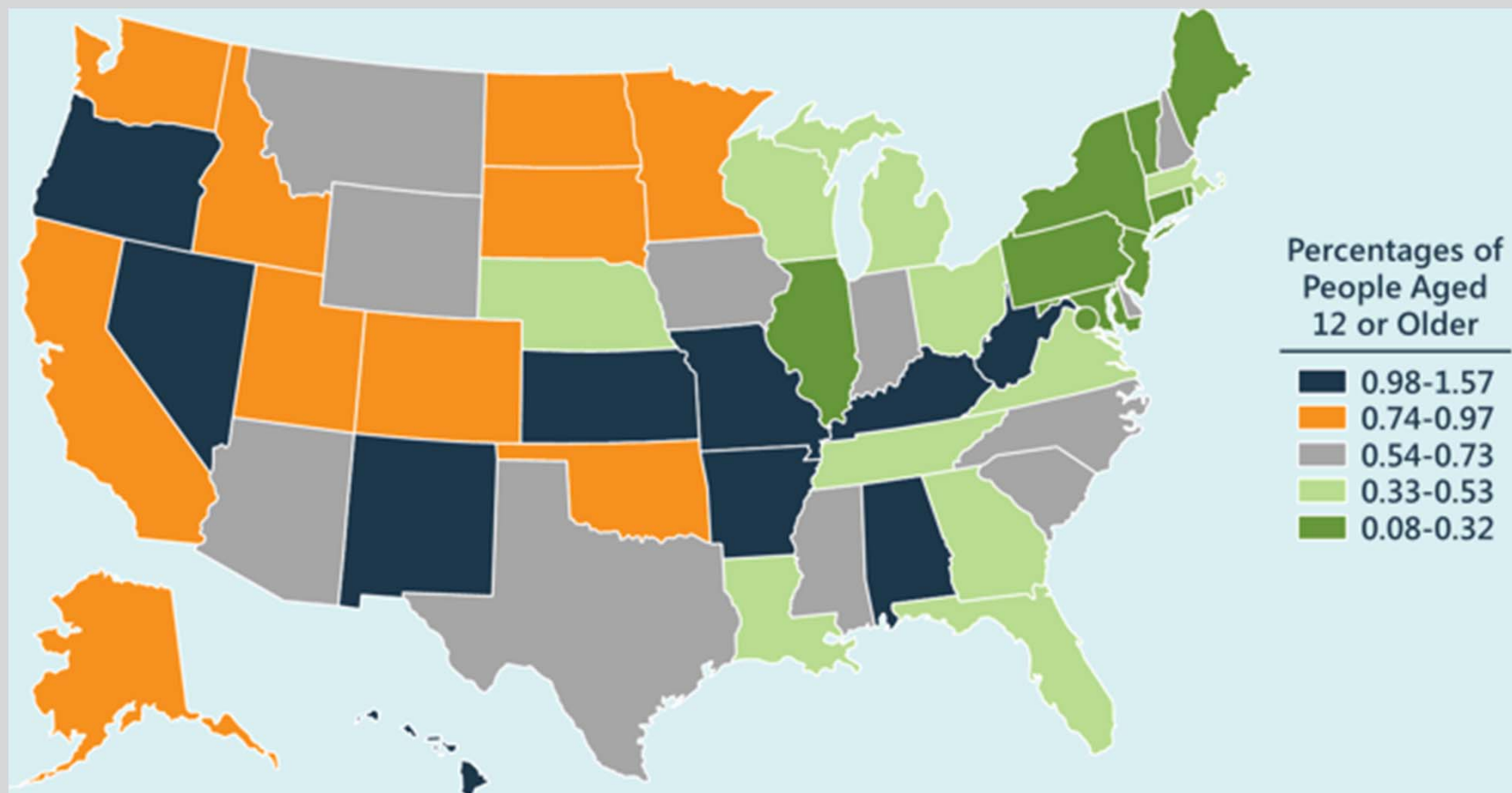
SOURCE: SAMHSA, 2019

What Happens if you Layer in Past Year Misuse of Opioids (as Percentages)? (2018)



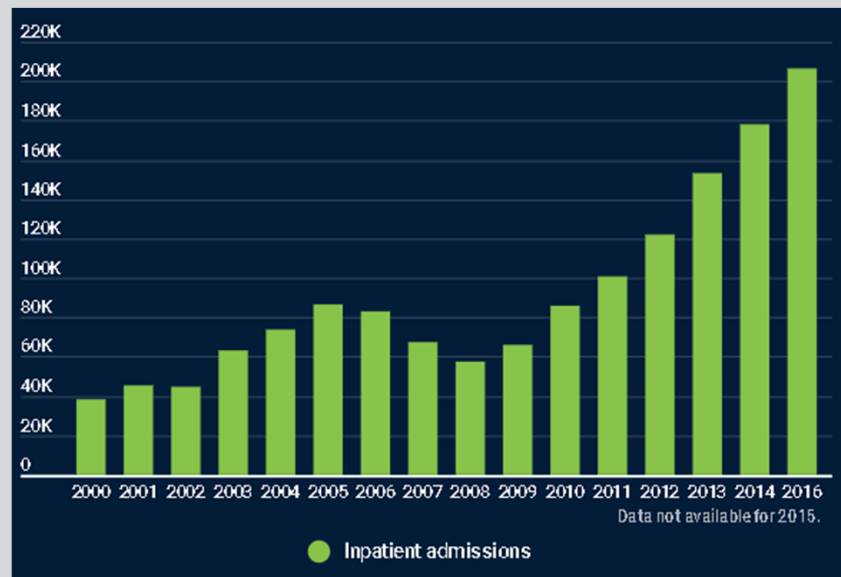
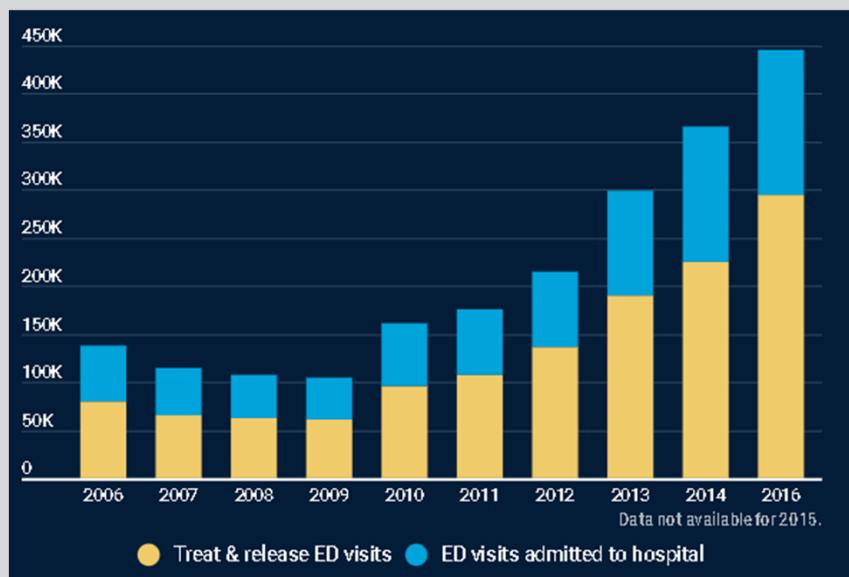
SOURCE: SAMHSA, 2019

Past Year Use of Methamphetamine by State, 2016-2017



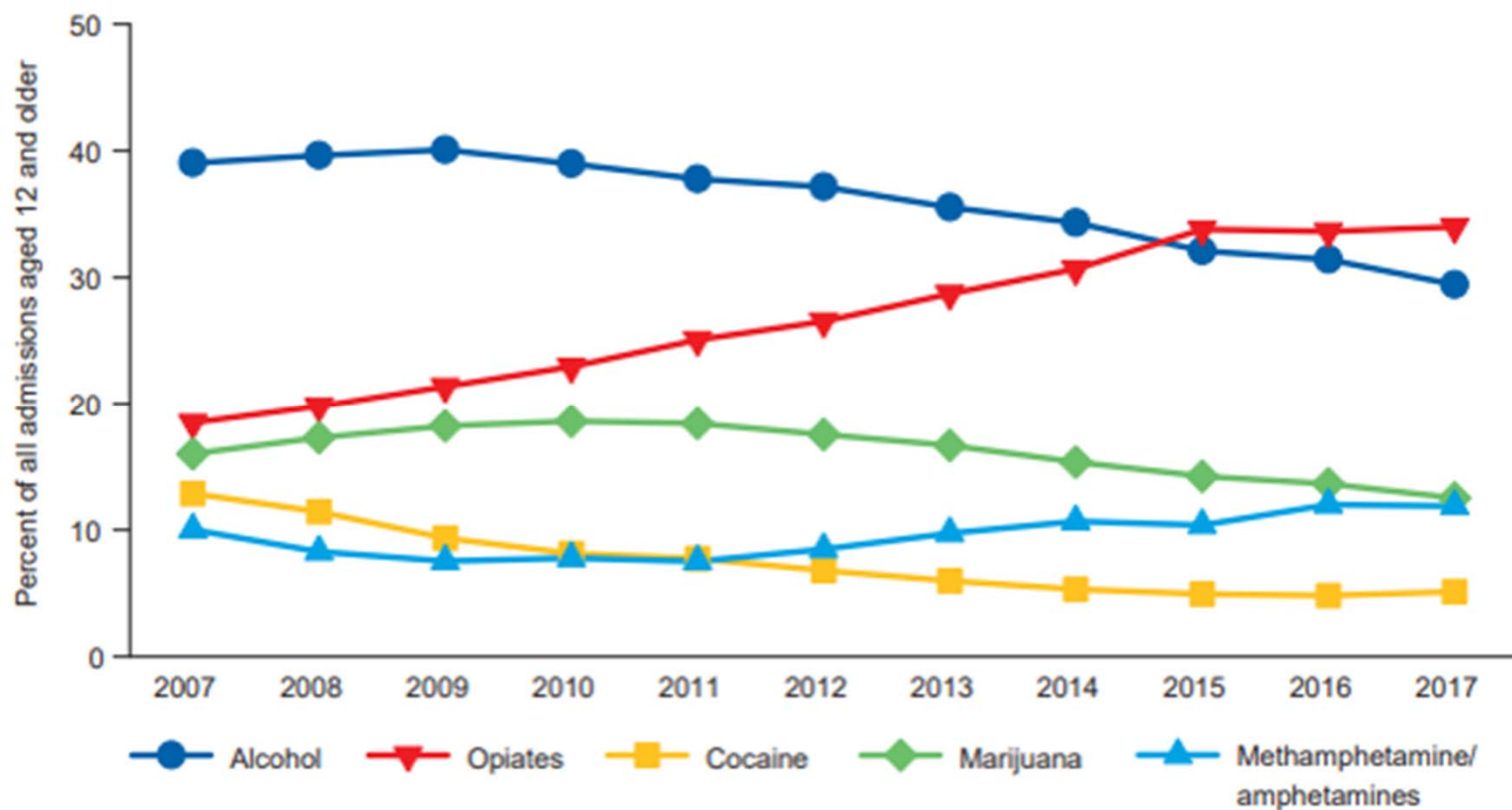
SOURCES: McCance-Katz, 2019; SAMHSA, 2019

The Impact of Methamphetamine on the U.S. Hospital System



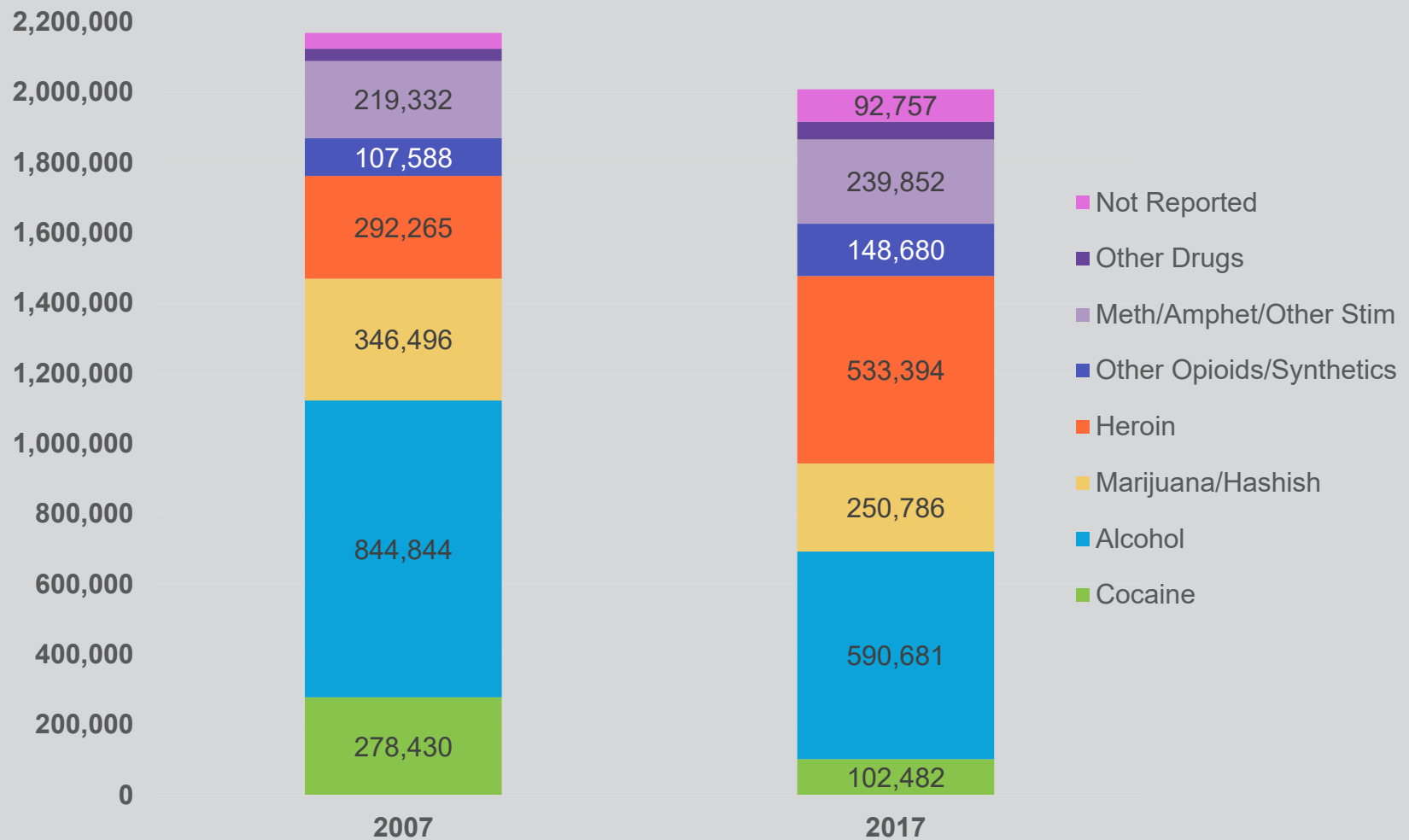
SOURCE: NIHCM Foundation, 2020

Primary Substance of Abuse at Admission, 2007-2017



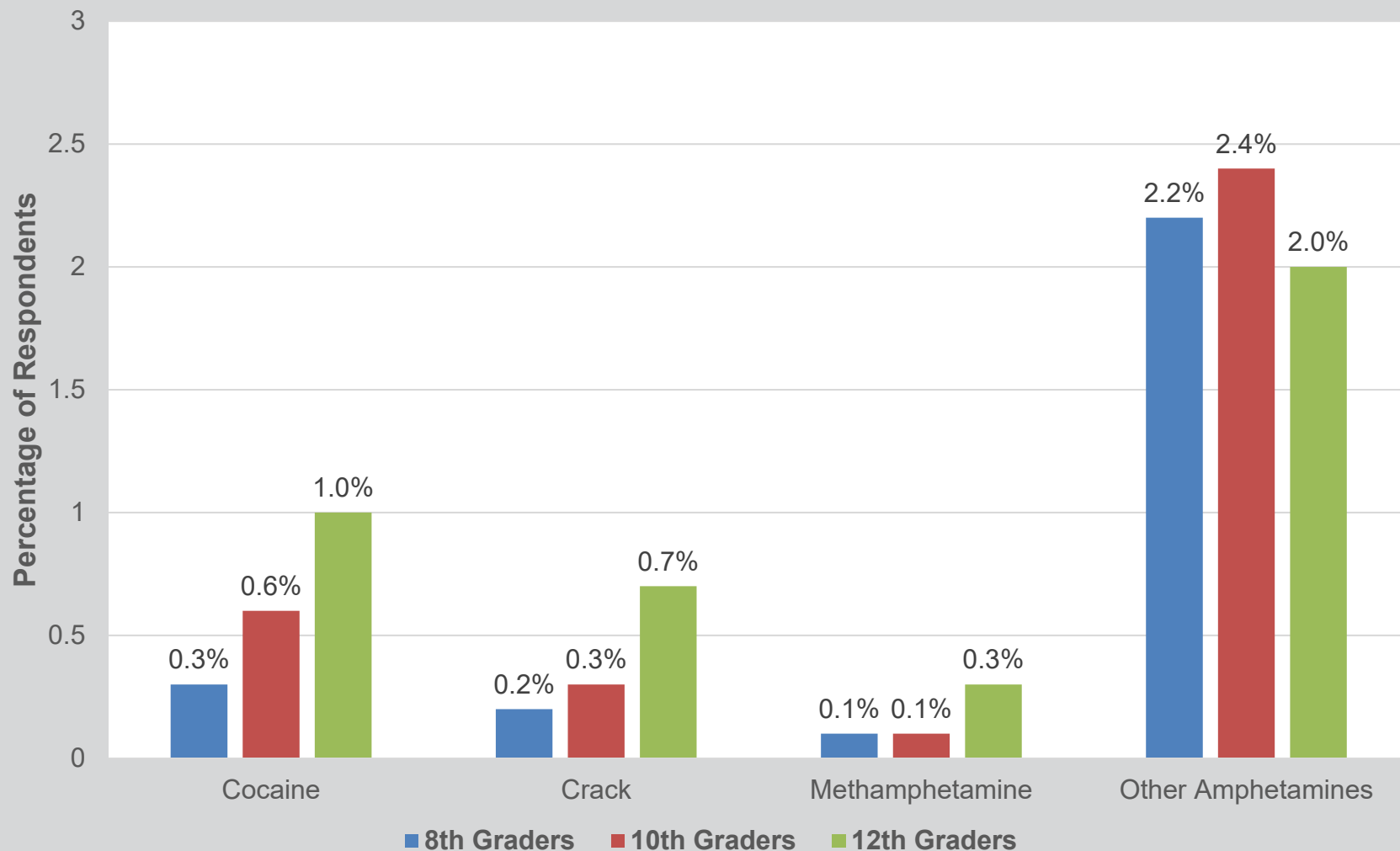
SOURCE: SAMHSA, 2019

Increases in Treatment Admissions Seen for Select Psychoactive Substances, 2007-2017



SOURCE: NIHCM Foundation, 2020

Past Month Use of Stimulants among 8th, 10th, and 12th Graders: 2019

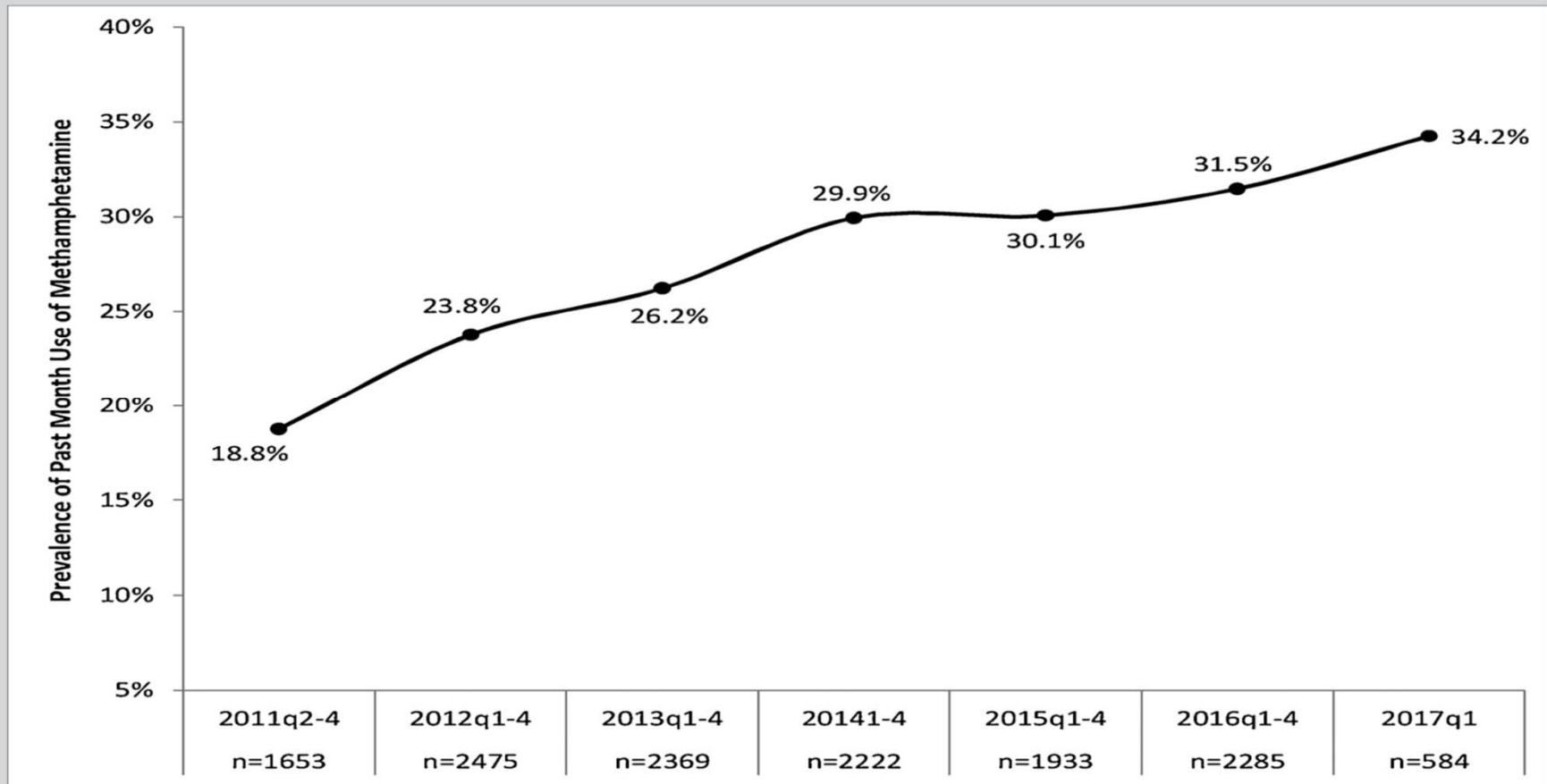


SOURCE: Miech et al., 2019

Methamphetamine and Opioid Co-Ingestion – What are the Issues?

- A **synergistic effect occurs** when using meth and an opioid together (i.e., the result of using both is greater than either alone)
- The stimulant effect counterbalances the depressant effect, thus **increasing overdose risk** (respiratory depression AND cardiac arrest)
- The **most potent effect** seems to be in the **first 90 minutes** of co-ingestion

Past Month Use of Methamphetamine among People Seeking Treatment for an Opioid Use Disorder

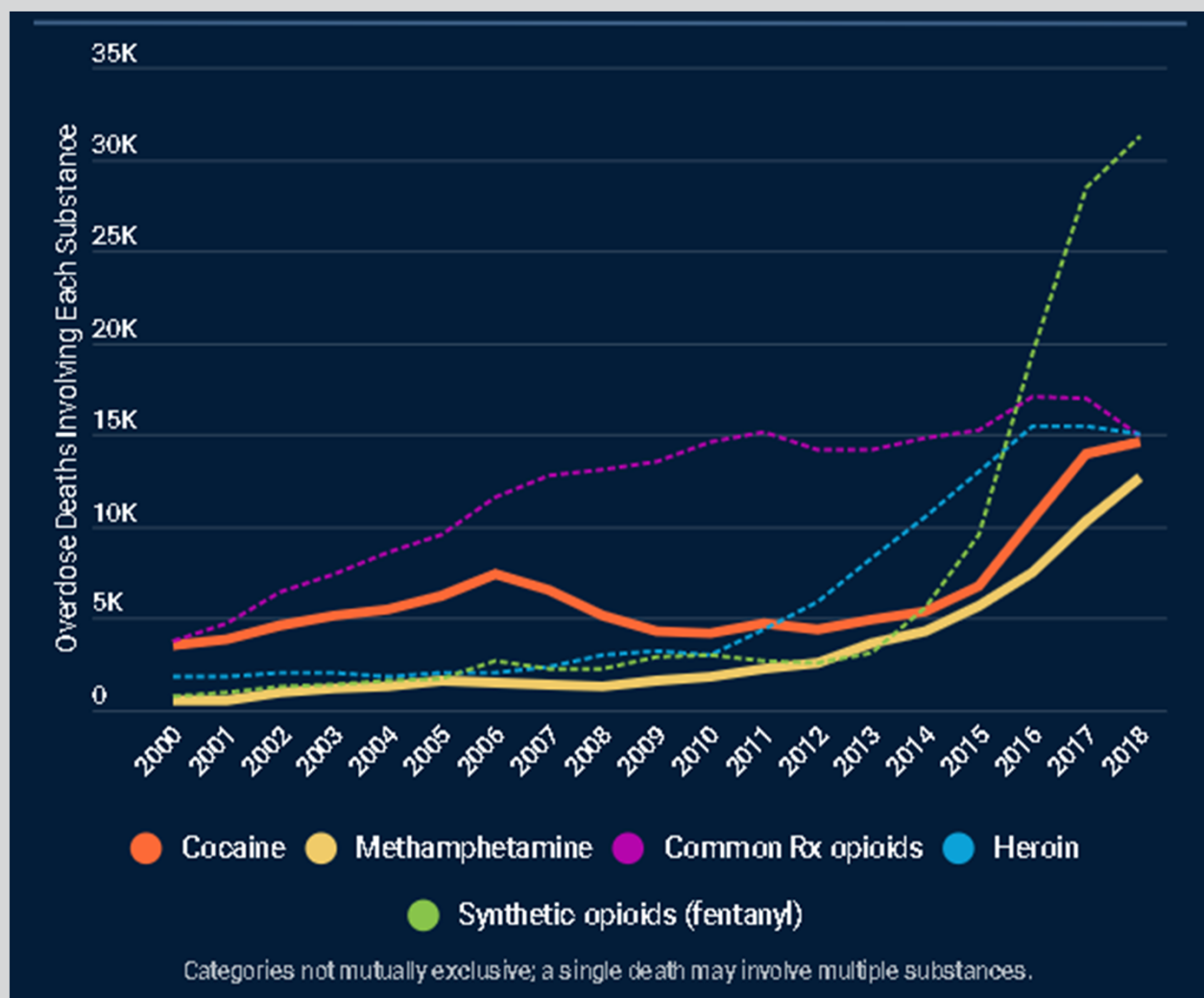


SOURCE: Ellis et al., 2018

What are Some Treatment Implications for Methamphetamine and Opioid Co-Ingestion?

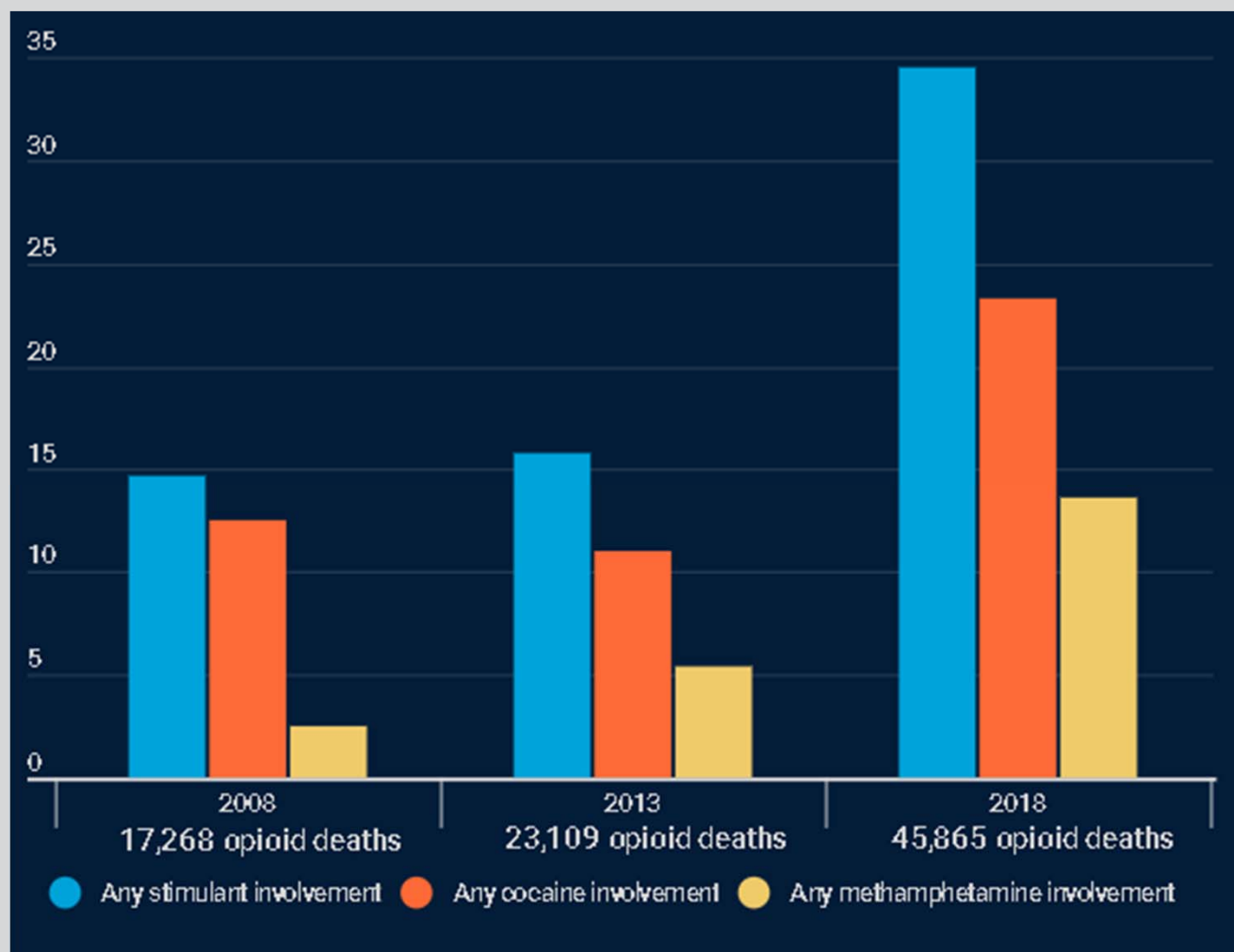
- Make sure you have sufficient **naloxone kits** available for overdoses
 - Because of the interaction effect, it may require more than one dose to counteract the effects of meth and heroin
- Combine **medication-assisted treatment for heroin with contingency management for meth**
 - It may be better to use buprenorphine rather than methadone, since methadone and meth would still have a potent interaction (for people who relapse on meth during treatment)
- **Exercise** may help to **reduce methamphetamine use and reduce depression and anxiety symptoms**

An Emerging Pattern of Increased Deaths Involving Stimulants



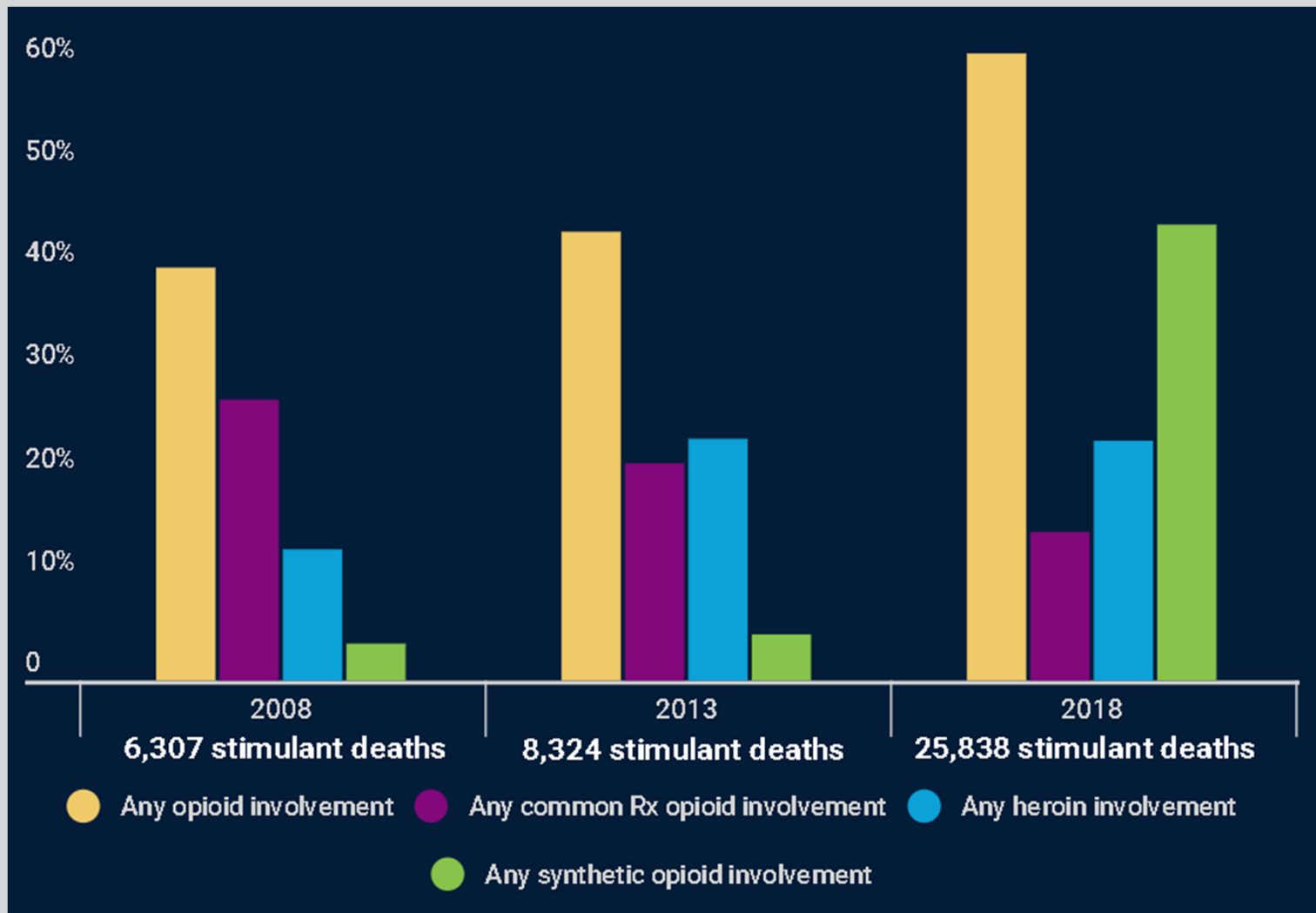
SOURCE: NIHCM Foundation, 2020

A Growing Percentage of Opioid-Related Deaths also Involve Stimulants



SOURCE: NIHCM Foundation, 2020

Increases Seen in Stimulant-Related Deaths that also Involve Opioids



SOURCE: NIHCM Foundation, 2020



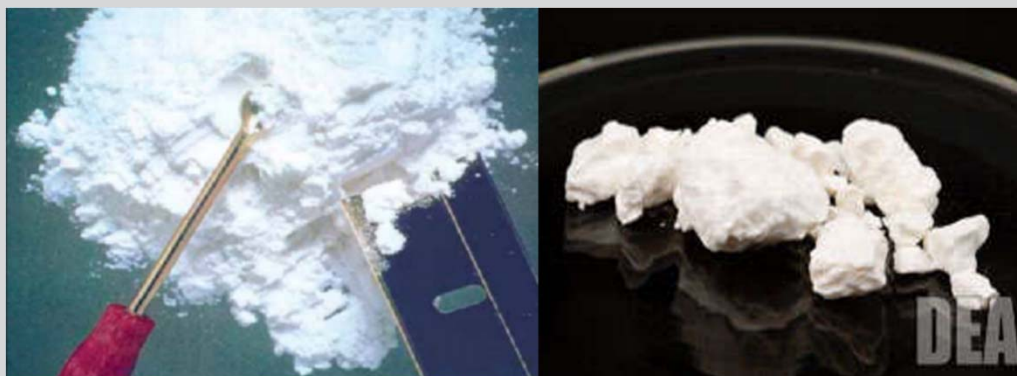
Stimulants: What are We Talking About?

The Broader Classification: Stimulants

Methamphetamine



Powder and Crack Cocaine

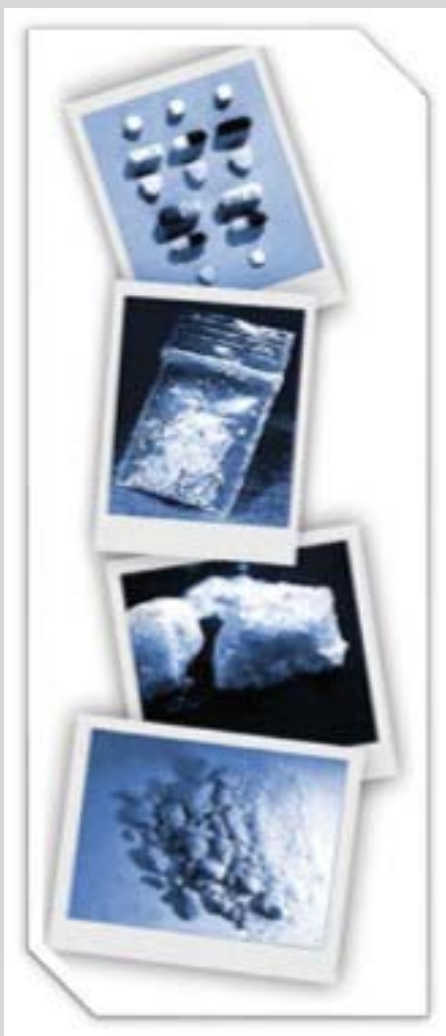


Forms of Cocaine

- Powder cocaine (Hydrochloride salt)
- Smokable cocaine (Crack, rock, freebase)
- Cocaine half-life: ~1-2 hours



Methamphetamine



Methamphetamine Powder

*Description: Beige/yellowy/
off-white powder*

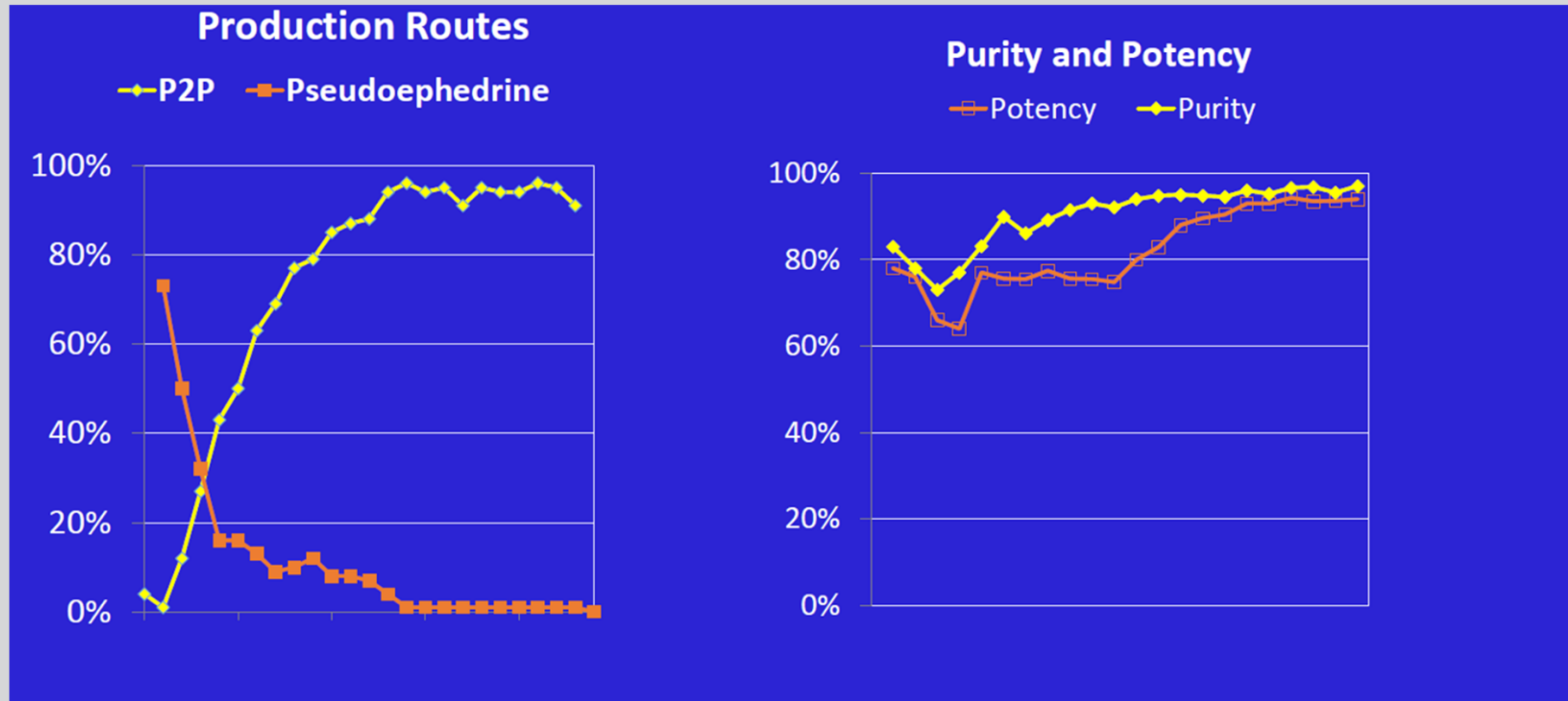
Base / Paste Methamphetamine

*Description: 'Oily', 'gunky', 'gluggy' gel,
moist, waxy*

Crystalline Methamphetamine

*Description: White/clear crystals/rocks;
'crushed glass' / 'rock salt'*

DEA Methamphetamine Profiling Program: National Data, 2006-2018



SOURCES: Maxwell, 2019;
U.S. DEA, 2019

Cocaine vs. Methamphetamine

Methamphetamine

- Stimulant
- Man-made
- Smoking produces a long-lasting high
- 50% of drug is removed from body in 12 hours
- Increases dopamine release and blocks dopamine re-uptake
- Limited medical use

Cocaine

- Stimulant and local anesthetic
- Plant-derived
- Smoking produces a brief high
- 50% of drug is removed from body in 1 hour
- Blocks dopamine re-uptake
- Limited use as a local anesthetic (surgical)

The Impact of Stimulants on the Brain and Body



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Substance Use Disorder is a Brain Disease



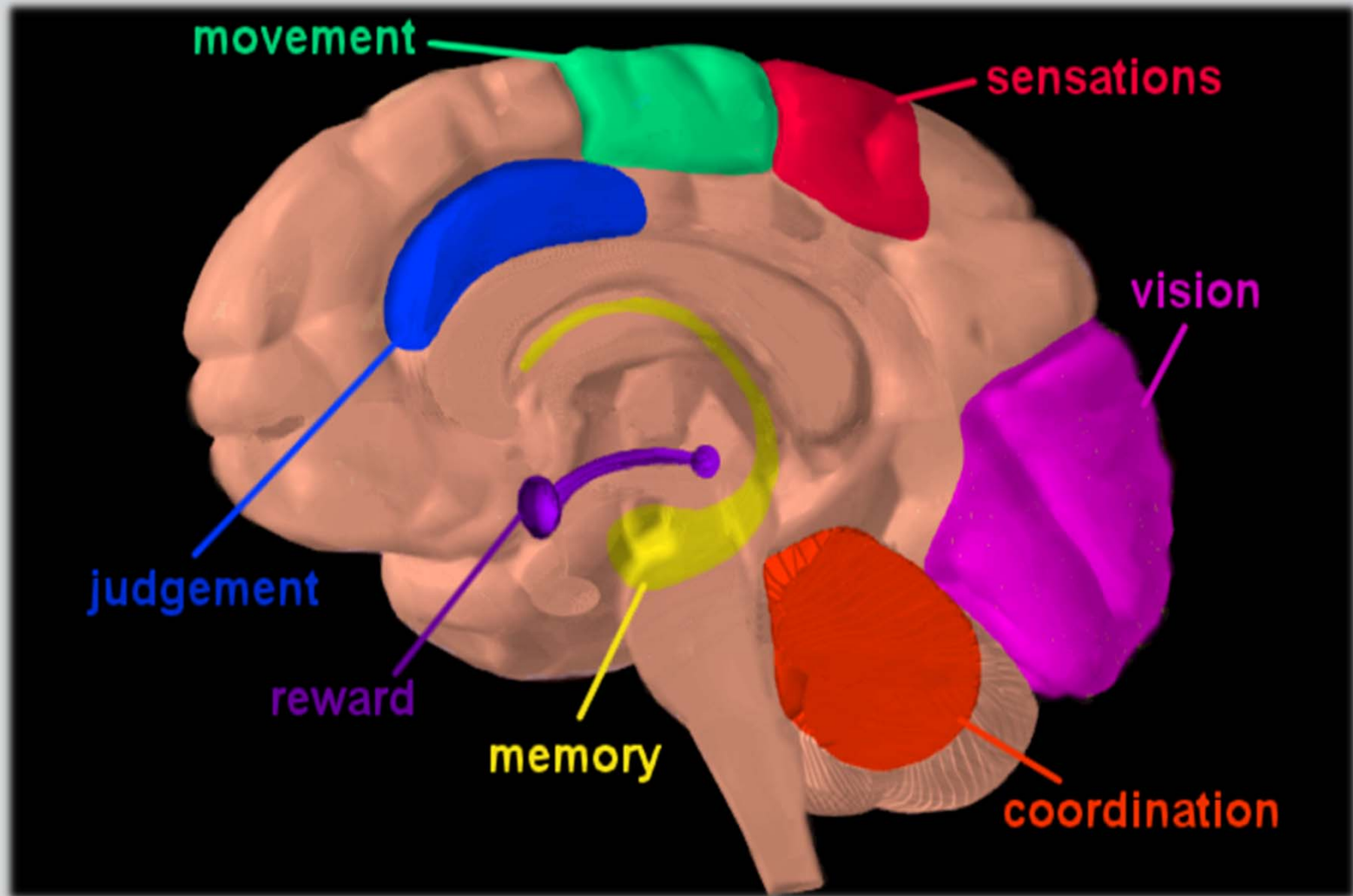
- “Addiction is a brain disease”

Alan Leshner, Ph.D.

Former Director, National Institute on Drug Abuse

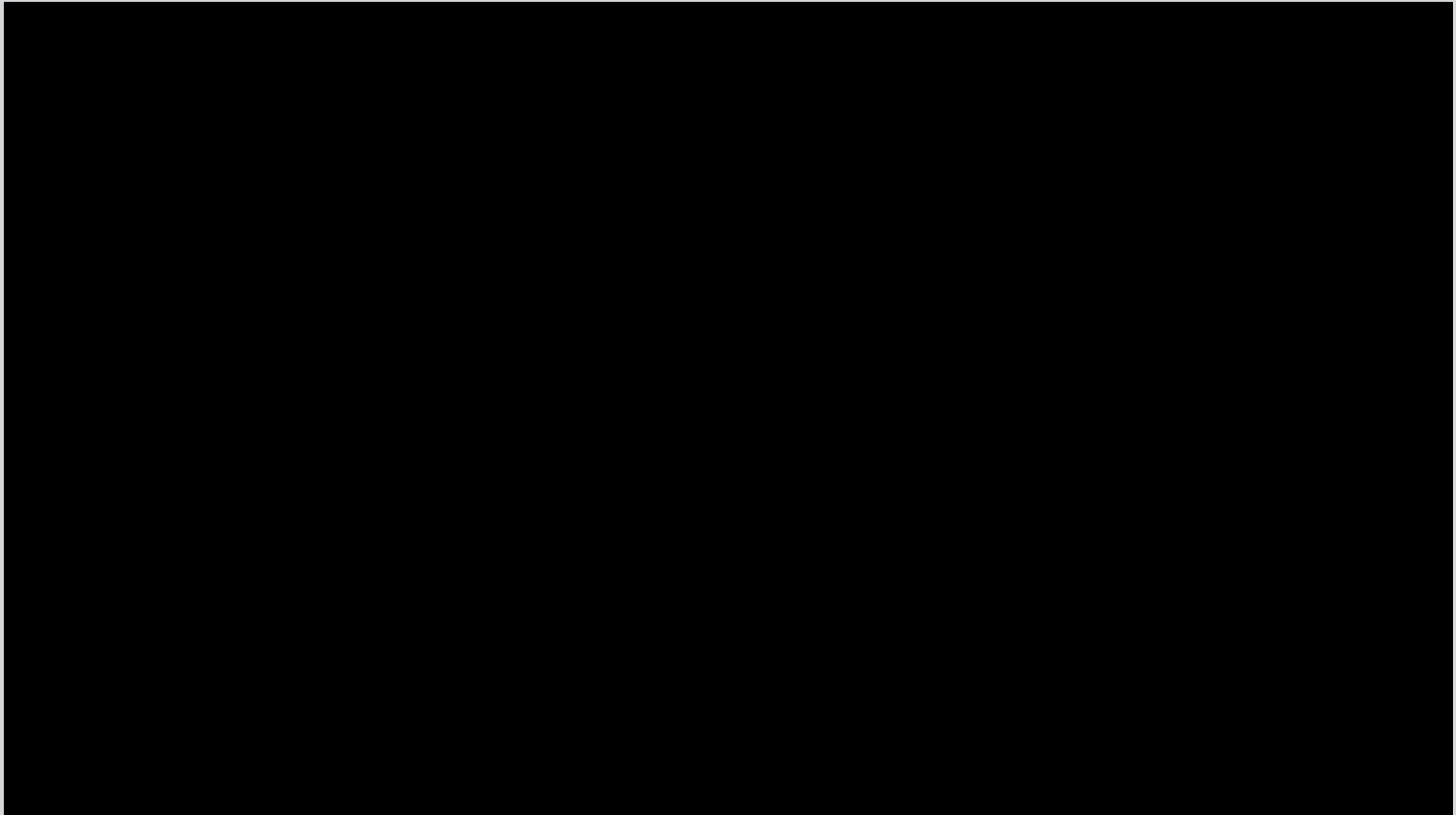
- This statement in the late 1990’s began to change the way drug abuse/dependence were viewed, at least by the medical and scientific communities
- Unfortunately, much stigma remains among general public as well as among healthcare providers

Brain Areas Affected by Psychoactive Substances



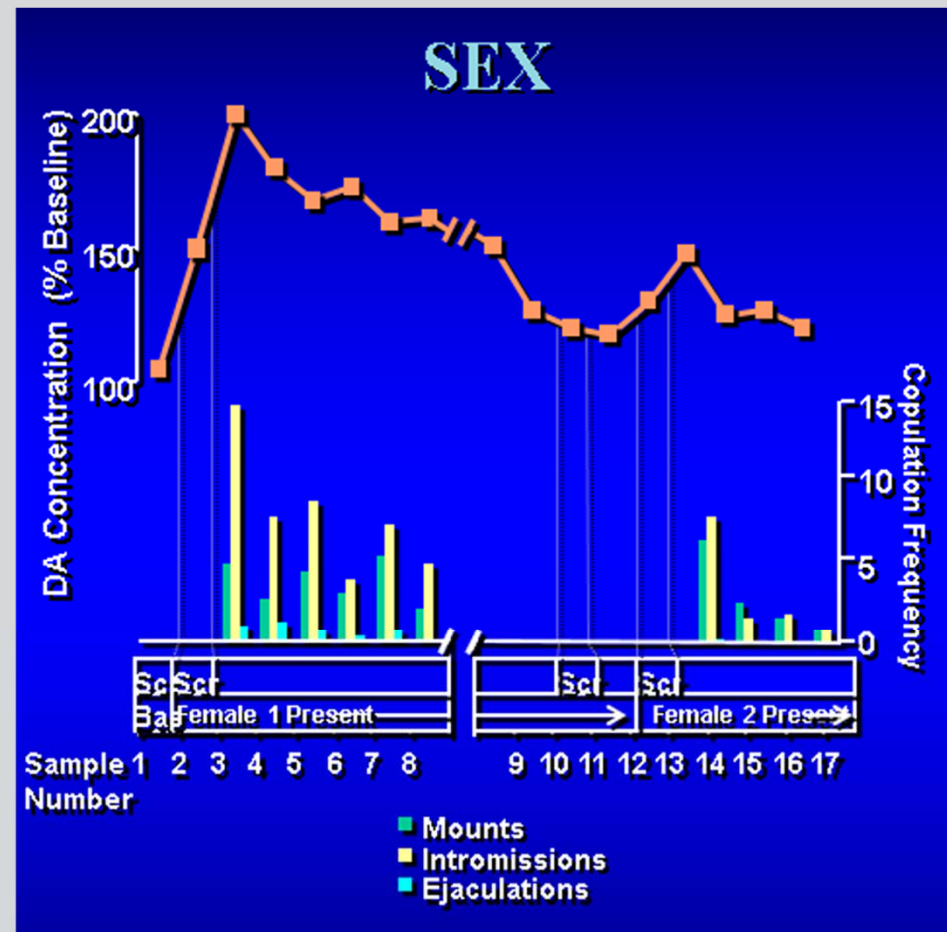
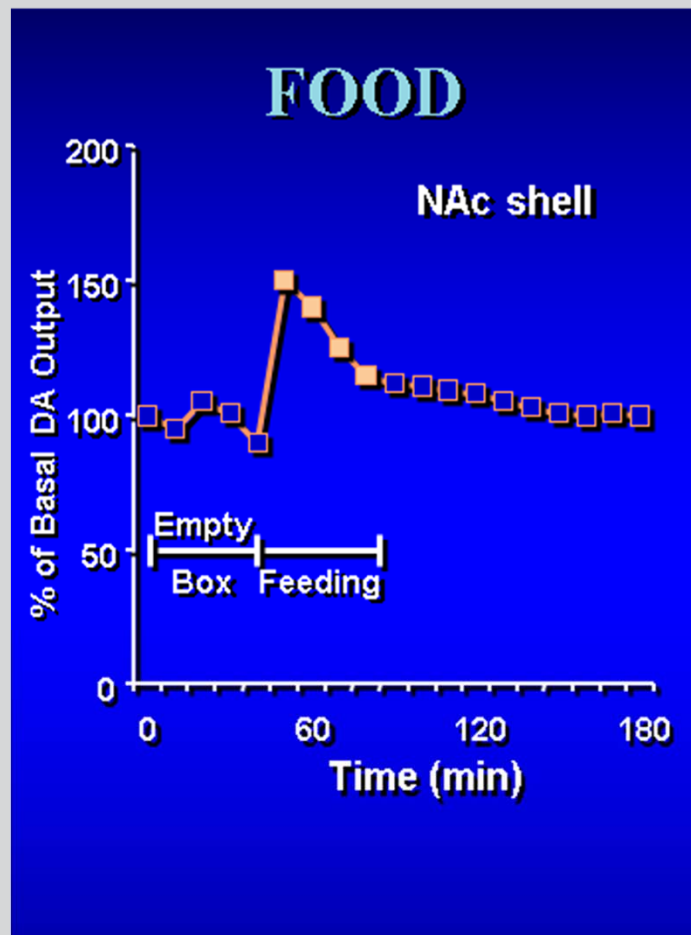
SOURCE: NIDA, 2019

Let's First Take a Look at Normal Dopamine Functioning



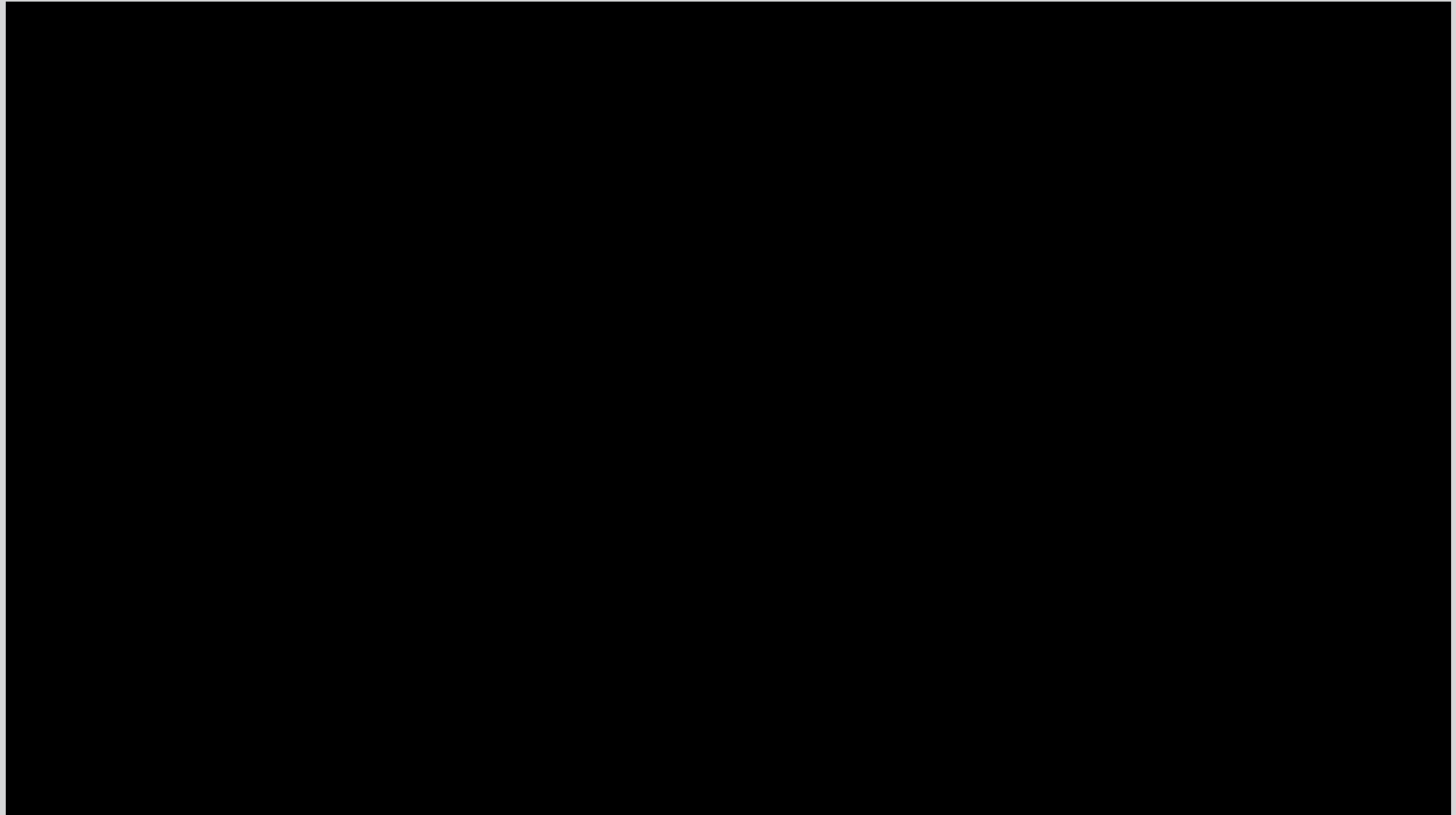
SOURCE: Meyers, 2008

Natural Rewards Elevate Dopamine Levels



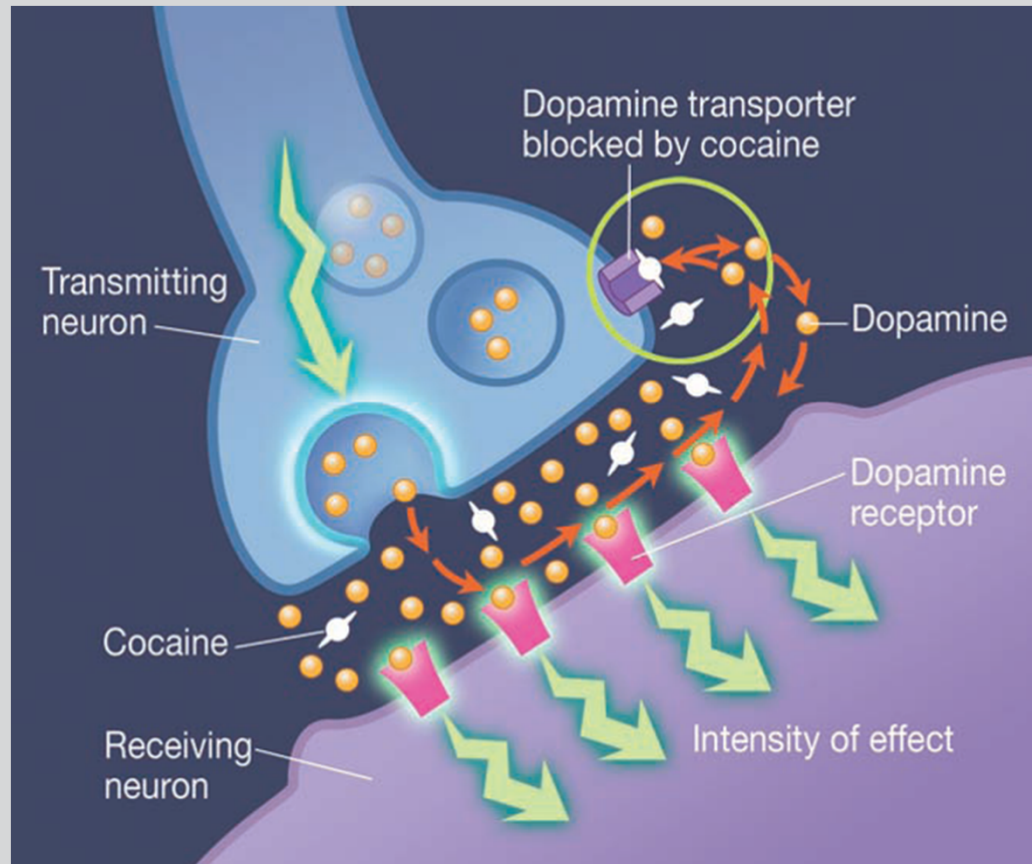
SOURCES: Bassareo & DiChiara, 1999;
Fiorino & Phillips, 1997

How the Brain Responds to Methamphetamine



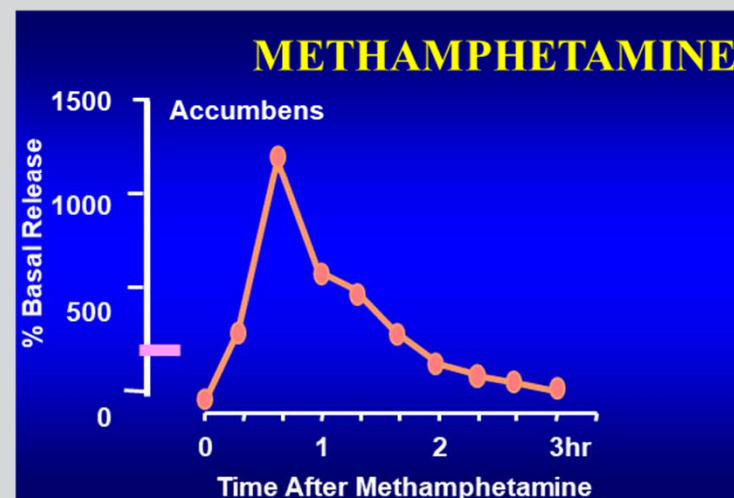
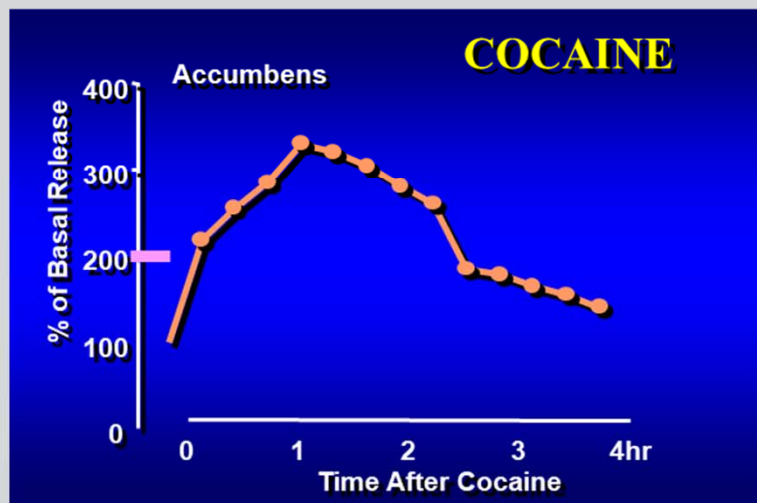
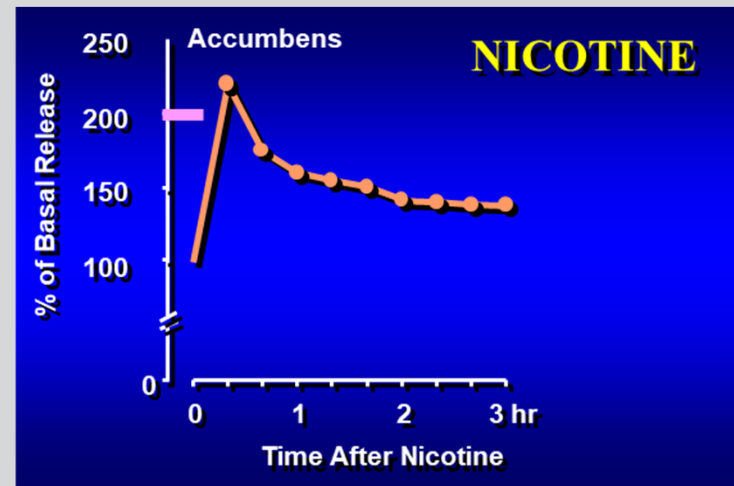
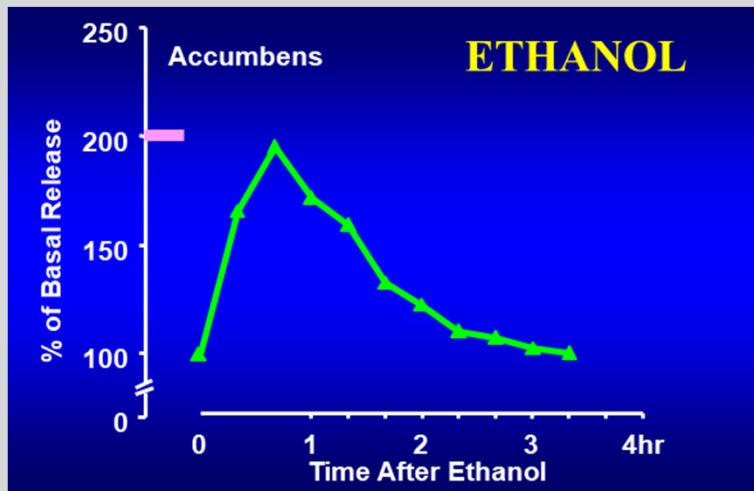
SOURCE: Meyers, 2008

How Does Cocaine Produce its Effects?



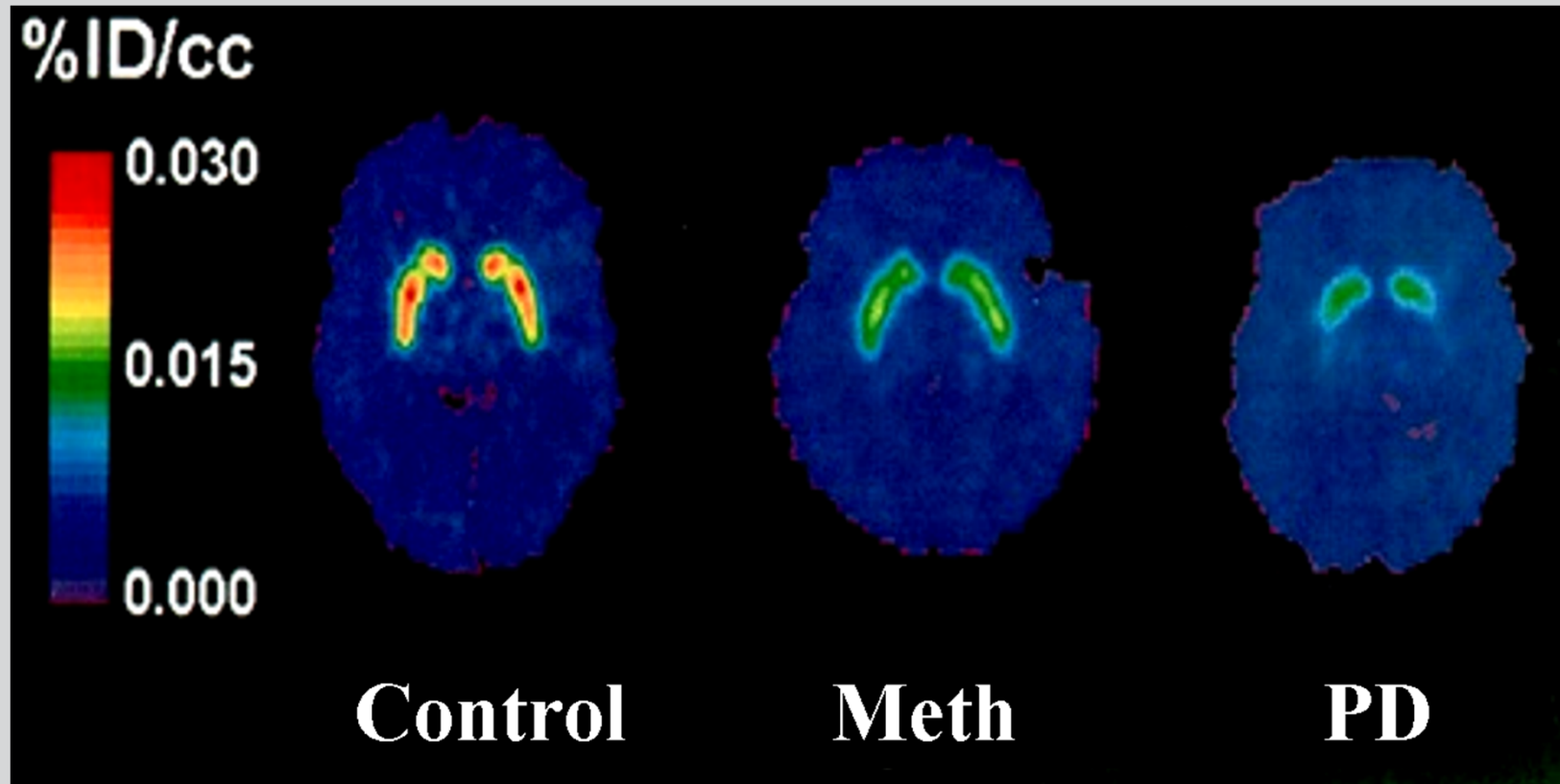
SOURCE: NIDA, 2016

Effects of Drugs on Dopamine Release



SOURCES: Shoblock et al., 2003;
DiChiara & Imperato, 1988

Decreased Dopamine Transporter Binding: Use of Meth and Parkinson's Disease



SOURCE: McCann et al., 1998

What Do Newer Research Studies Say?

- A 2011 study examined 300,000 hospital records spanning 16 years and found that patients with methamphetamine use disorders were **75% more likely** to develop Parkinson's disease.
- A 2015 study in Utah found that people who use methamphetamine were **300% more likely** to develop Parkinson's disease compared to those who did not use drugs or those who used cocaine.
 - Study also found that risk may be higher for females.
- A 2018 study concluded that methamphetamine use, along with other risk factors that a person may have, **may be an initiating event** in the development of Parkinson's Disease.



Acute and Chronic Effects of Stimulants

Acute Physical Effects of Stimulants



Increases

- Heart rate
- Blood pressure
- Pupil size
- Respiration
- Sensory acuity
- Energy

Decreases

- Appetite
- Sleep
- Reaction Time

Acute Psychological Effects of Stimulants



Increases

- Confidence
- Alertness
- Mood/Euphoria
- Sex drive
- Energy
- Talkativeness

Decreases

- Boredom
- Loneliness
- Timidity

Chronic Physical Effects of Stimulants



- Tremor
- Weakness
- Dry mouth
- Weight loss
- Cough
- Sinus infection
- Dental Problems
- Sweating
- Burned lips; sore nose
- Oily skin/complexion
- Headaches
- Diarrhea
- Anorexia

Chronic Psychological Effects of Stimulants



- Confusion
- Concentration
- Hallucinations
- Fatigue
- Memory loss
- Insomnia
- Irritability
- Paranoia
- Panic reactions
- Depression
- Anger
- Psychosis

Chronic Stimulant Use (1)



Acute overdose:

- Severe hyperthermia
- Convulsions
- Severe dehydration
- Rhabdomyolysis (too much myoglobin being filtered by the kidneys) → acute renal failure
- Stroke
- Myocardial infarction

Chronic Stimulant Use (2)



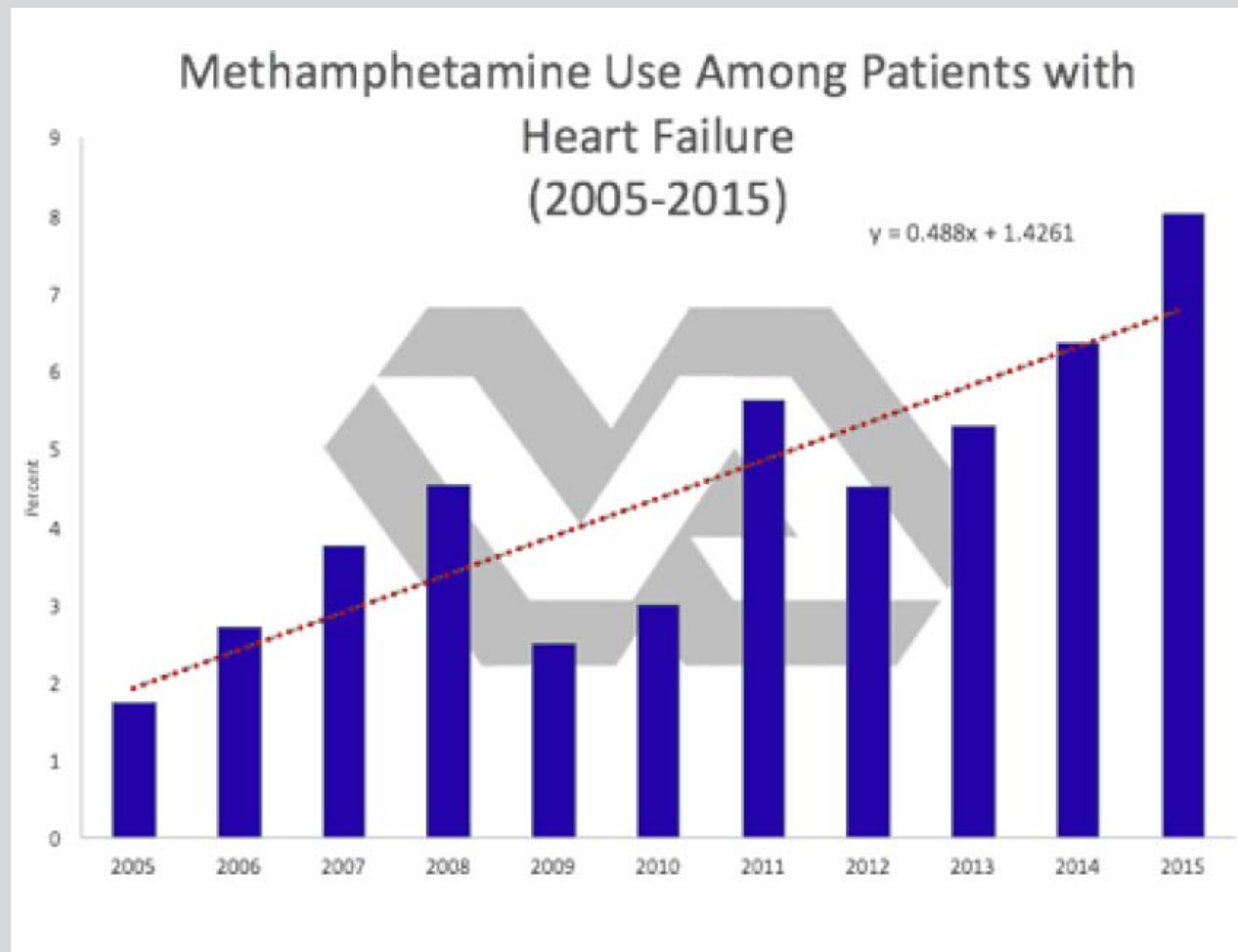
Organ system damage

- **Respiratory** (pulmonary hypertension, difficulty breathing, pleuritic chest pain, decreased capacity)
- **Neurological** (stroke, seizure, hemorrhage, cerebral vasculitis)
- **Renal failure** (resulting from rhabdomyolysis)
- **Hepatic failure** (resulting from rhabdomyolysis)
- **Cardiac** (tachycardia, arrhythmia, reduced heart rate variability, myocardial infarction, heart failure)

Psychological effects

- **Psychosis** (hallucinations, delusions)
- **Affective** (depression, suicidal ideation, mania)

Methamphetamine-Associated Heart Failure



SOURCE: Nishimura et al., 2017

Other Chronic Methamphetamine Problems



- Eye ulcers
- Over-heating
- Obstetric complications
- Anorexia / weight loss
- Tooth wear, cavities
- “Speed bumps”

Did I Mention Skin Problems?



- Grayish leathery texture to skin
- Increased sweating (hyperhidrosis)
- Repetitive or compulsive skin picking
 - “Speed bumps” / Formication

Use of Methamphetamine Leads to Severe Tooth Decay



- Methamphetamine-related dental issues are characterized by severe tooth decay and gum disease
- Teeth often break or fall out

Effects of Stimulant Use During Pregnancy



- Maternal migraines and seizures
- Premature membrane rupture
- Separation of placental lining from uterus prior to delivery
- High blood pressure
- Edema and seizures
- Spontaneous miscarriage
- Preterm labor
- Difficult delivery

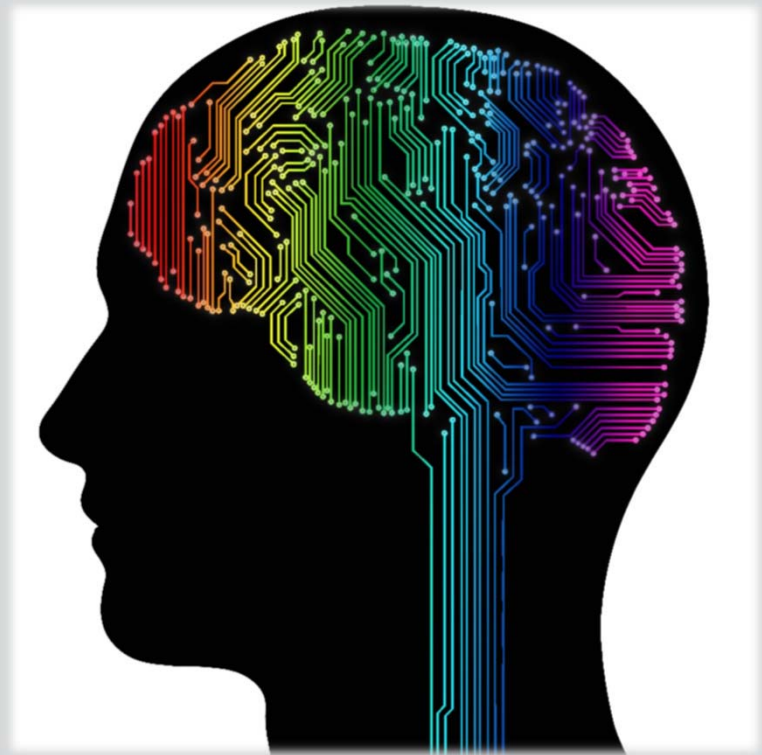
SOURCES: Smid et al., 2019; NIDA, 2016; Cain et al., 2013; Volkow, 2005

Additional Effects of Methamphetamine

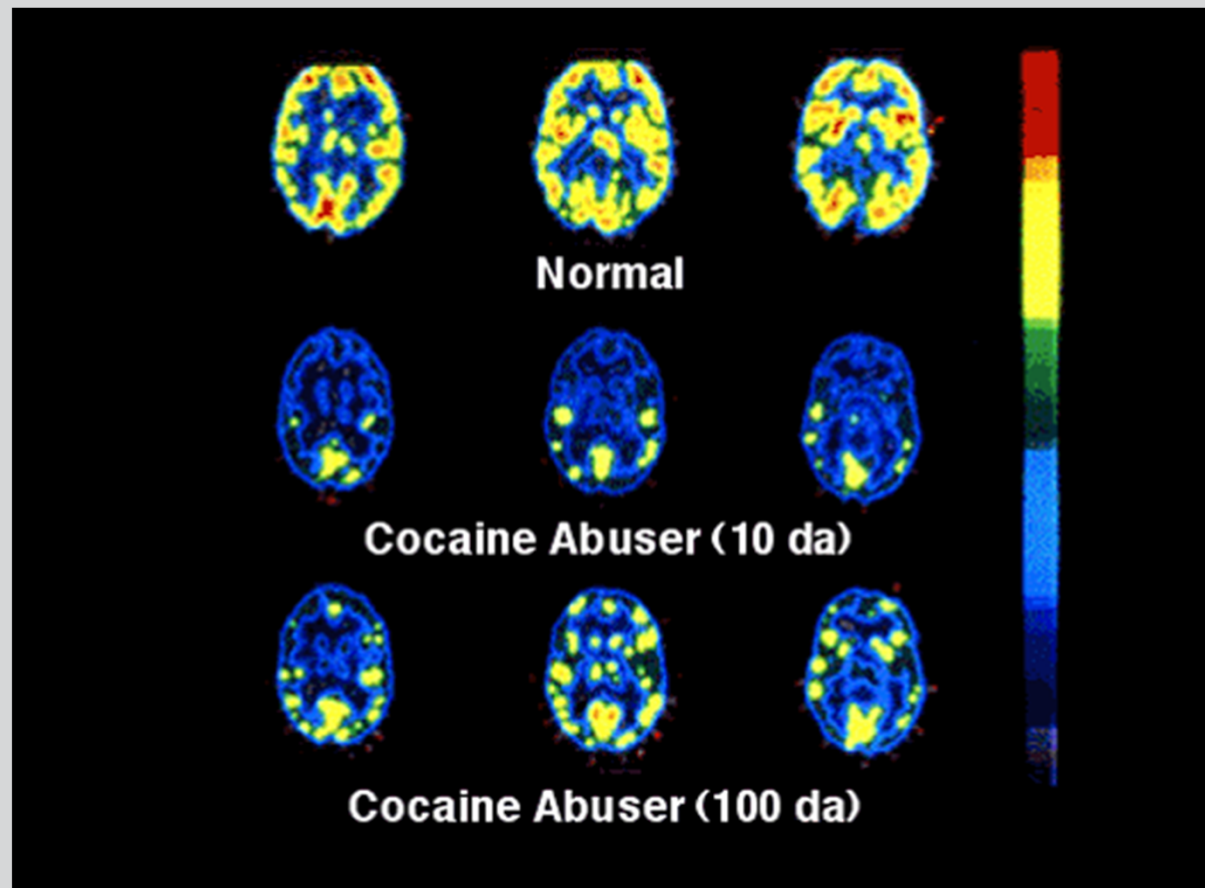


- Cardiac and brain abnormalities
- Neurological problems
 - Decreased arousal
 - Increased stress
 - Attention impairments

Cognitive and Memory Effects of Stimulant Use

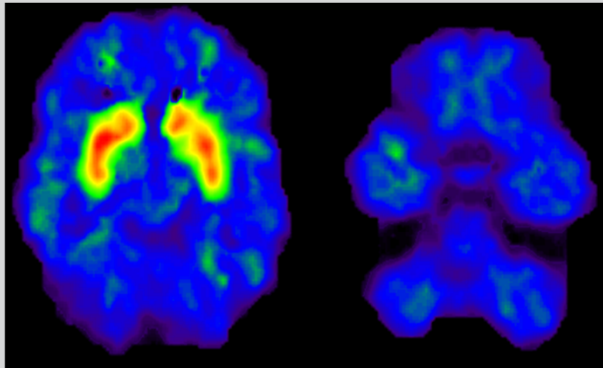


Long-Term Impact of Cocaine Use

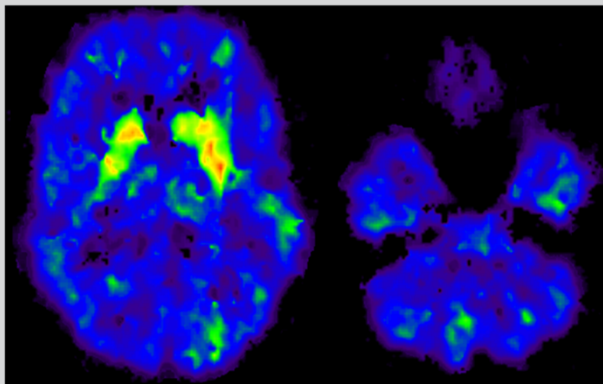


SOURCES: NIDA, 2019; Volkow et al.,
1993; Volkow et al., 1992

Dopamine Transporters in People who Use Methamphetamine

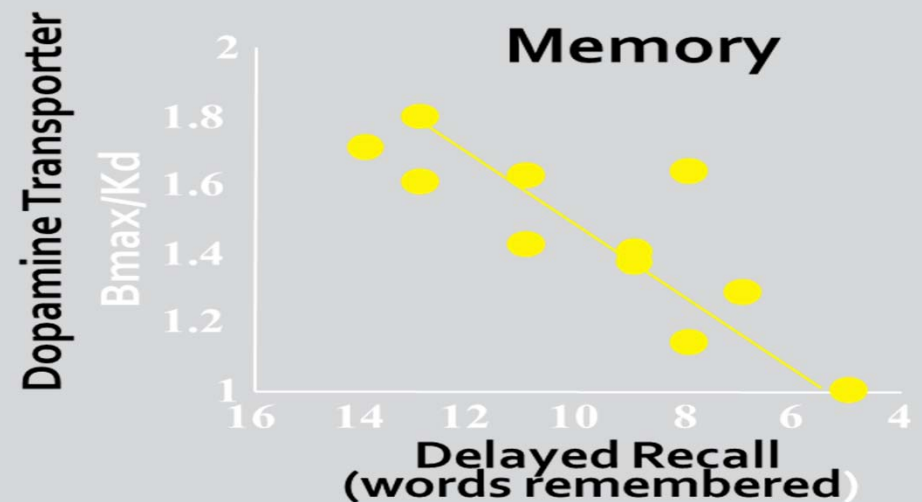
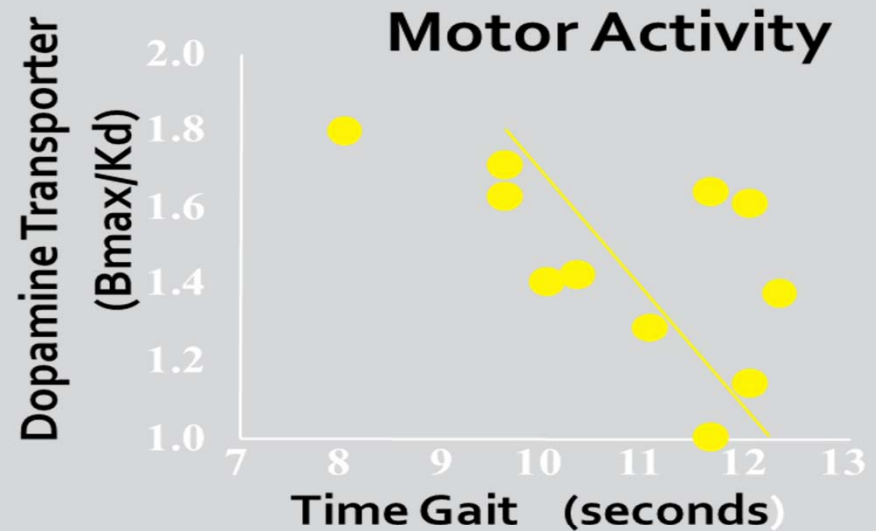


Normal Control



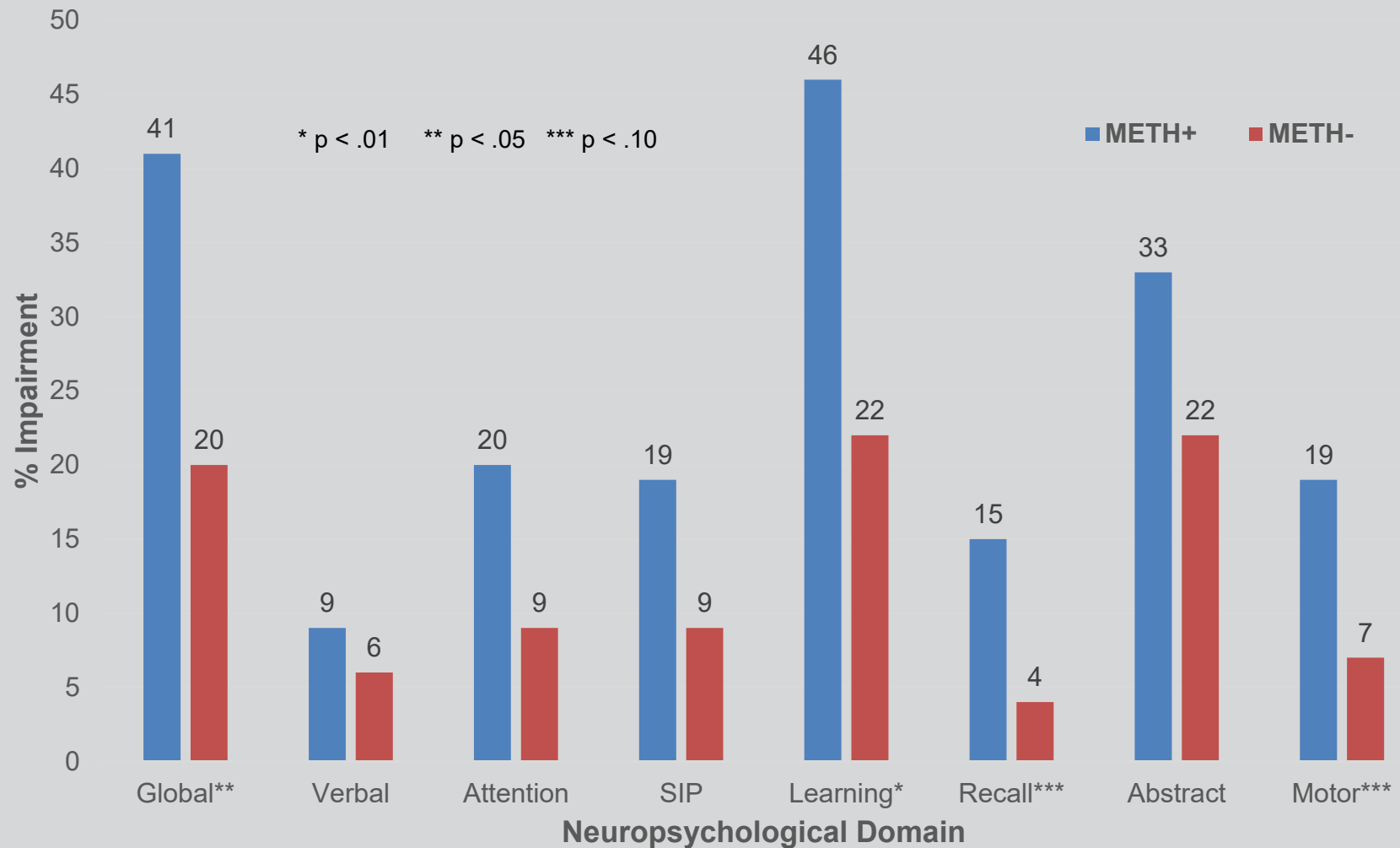
Methamphetamine Abuser

$p < 0.0002$




SOURCE: Volkow et al., 2001

Neuropsychological Functioning and Methamphetamine Use



SOURCE: Cherner et al., 2010

Motor and Cognitive Impairment Associated with Methamphetamine Use



- Those METH+ participants with motor impairments were found to have higher rates of meth use.
- For METH+ with cognitive impairment (vs those without) showed no difference in meth exposure.
- A meta analysis also found significant difference across studies, but poor controls for confounding variables.
- Investigators also noted that while difference existed between those who had used meth and controls, the meth group was still within normal ranges. Perhaps the differences are of little clinical significance.
- There is a great need to study individual differences in vulnerability to methamphetamine-associated neurotoxicity, and meth use alone does not explain it.

Cognitive Deficits in Methamphetamine Use Disorder

- Compared 108 methamphetamine treatment seekers and 50 matched controls.
- Methamphetamine use was associated with **impulsive decision making** and **disinhibition**.
- Greater disinhibition associated with **longer durations of methamphetamine use**.

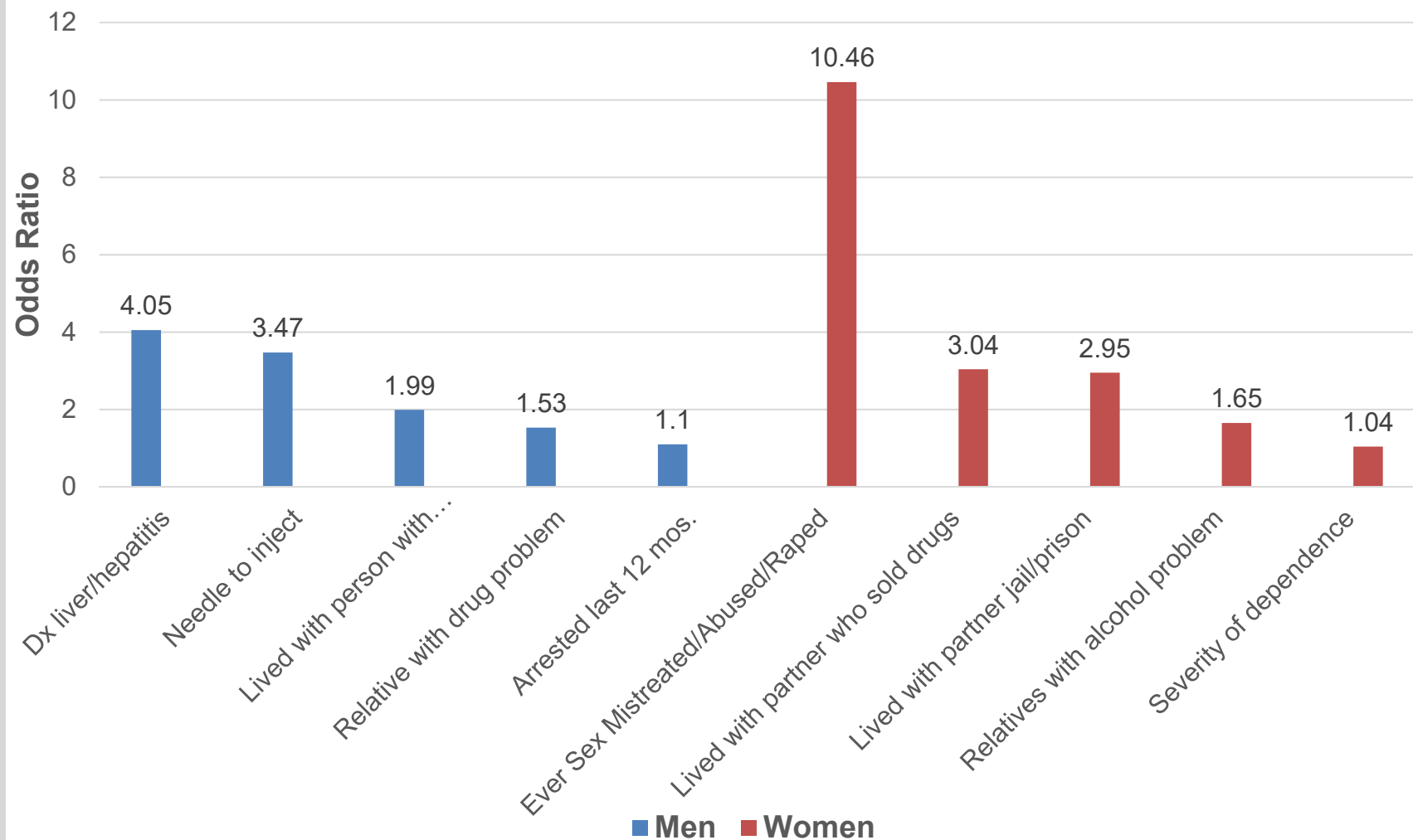


Methamphetamine Use and Violence

- Compared to no use, amphetamines use was associated with a 2-fold increase in the odds of hostility or violence
- Frequent use increases the risk of violent behavior
- Other risk factors included: psychotic symptoms, alcohol or other drug use, psychosocial problems, and impulsivity
- People who use methamphetamine are also more likely to be victims of abuse or violent acts
- Women who used methamphetamine are significantly more likely to experience partner abuse/violence




Top 5 Risk Factors for Men and Women Who Recently Entered Treatment for Meth (2)



SOURCES: Maxwell, 2019; Maxwell, 2014

Perceived Risks and Benefits of Methamphetamine Use



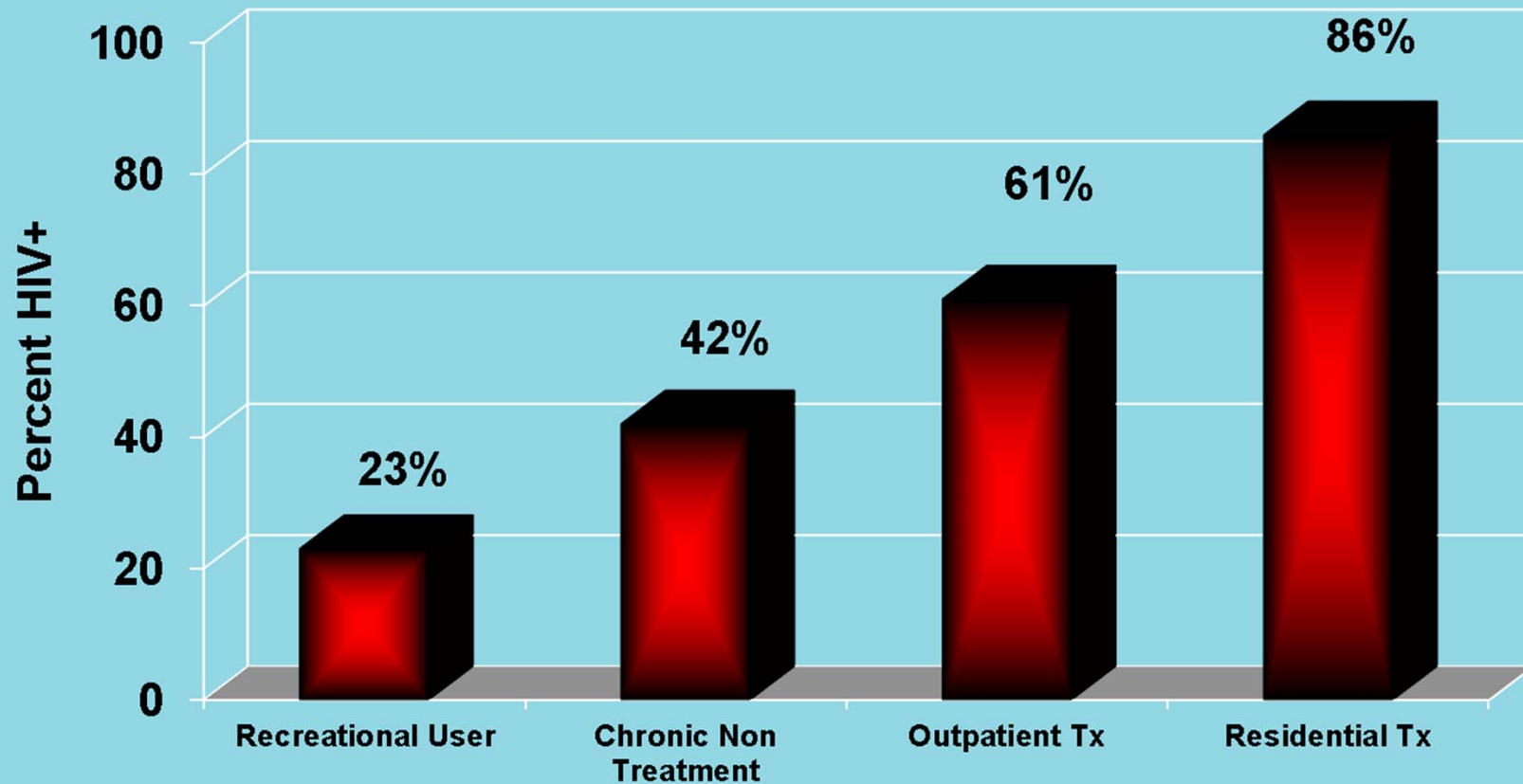
RISKS

- Cognitive impairment (74.8%)
- Addiction/Dependence (38.3%)
- Paranoia (37.9%)
- Depression (35.1%)
- Arrested in last 12 months (35.1%)

BENEFITS

- Increased energy/stay awake (57.1%)
- Enhanced sexual experience (43.3%)
- The high (40.0%)
- Fun/good time (34.3%)
- Enhanced mood/euphoria (28.6%)

Methamphetamine and HIV in MSM: A Time-to-Response Association?



SOURCE: Shoptaw & Reback, 2006

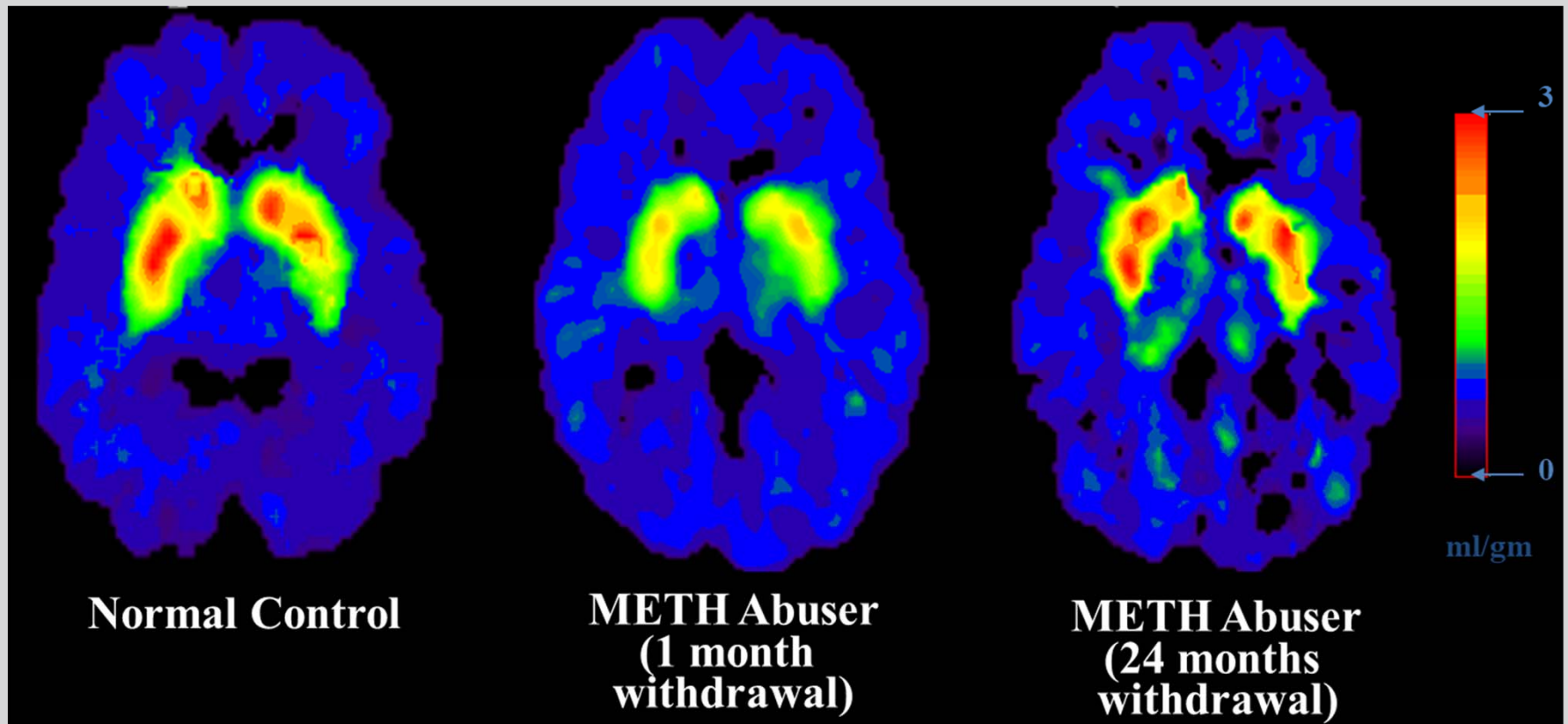
Treatment Considerations for People who Use Stimulants



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Partial Recovery of Brain Dopamine Transporters Following Protracted Abstinence



SOURCE: Volkow et al., 2001

Are there Medications for the Treatment of Stimulant Use Disorder?



- The short answer is **NO**
- A few medicines have had positive results in clinical trials
- To date, these medicines have not demonstrated reproducible results
- Much more research is needed to determine the overall efficacy of these medicines

Behavioral Treatments



- Contingency Management
- Community Reinforcement Approach
- Cognitive Behavioral Therapy/Relapse Prevention
- Motivational Interviewing
- Matrix Model
- Exercise
- Mindfulness

Psychosocial Interventions for Cocaine and Psychostimulant Amphetamine-Related Disorders

- Twenty-seven randomized controlled studies (3,663 participants) fulfilled inclusion criteria and had data that could be used for at least one of the main comparisons.
- Compared different behavioral interventions for retention in treatment and reducing stimulant use.
- Results showed using some form of **contingency management showed better results** both for reducing dropouts and lowering stimulant use.

Psychosocial Interventions for Individuals with Cocaine and Amphetamine Use Disorder



- Meta-analysis of 50 clinical studies (6,943 participants) on 12 different psychosocial interventions for cocaine and/or amphetamine addiction.
- The **combination of contingency management and community reinforcement approach**, was the most efficacious and most acceptable treatment both in the short and long term.

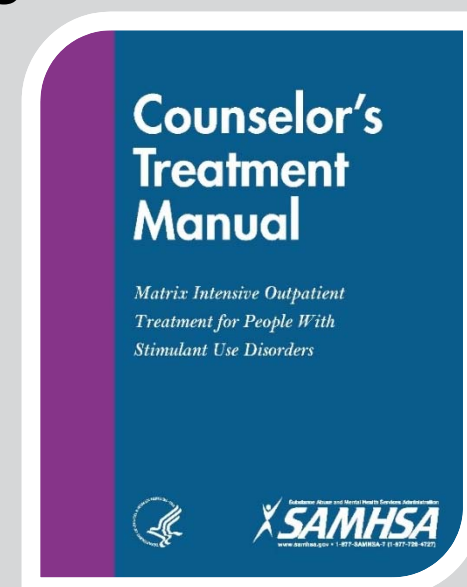
Responding to Global Stimulant Use: Challenges and Opportunities



- Psychosocial interventions other than contingency management have weak and non-specific effects on stimulant problems
- No effective pharmacotherapies have been approved
- Substantial research investment is needed to develop more effective, innovative, and impactful prevention and treatment

Behavioral Approach: Matrix Model

- 16-week **intensive outpatient** treatment was modestly better treatment as usual to improve retention and reduce methamphetamine use
- Therapist functions as **teacher and coach**
- Incorporates a variety of approaches
 - CBT
 - CM
 - MI
 - 12-Step Facilitation
 - Family Involvement
 - Person-centered therapy



Getting Off: A Behavioral Treatment Intervention for Gay and Bisexual Men Who Use Methamphetamine

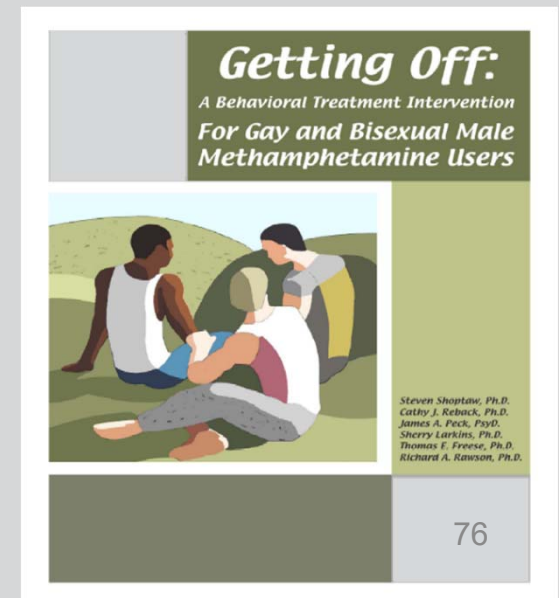
Contingency Management (CM):

- Provide increasingly valuable reinforcers for urine samples documenting drug abstinence

Gay-specific Cognitive Behavioral Therapy (GCBT):

- Cognitive Behavioral strategies for instilling abstinence and preventing relapse in a gay-specific HIV risk reduction intervention

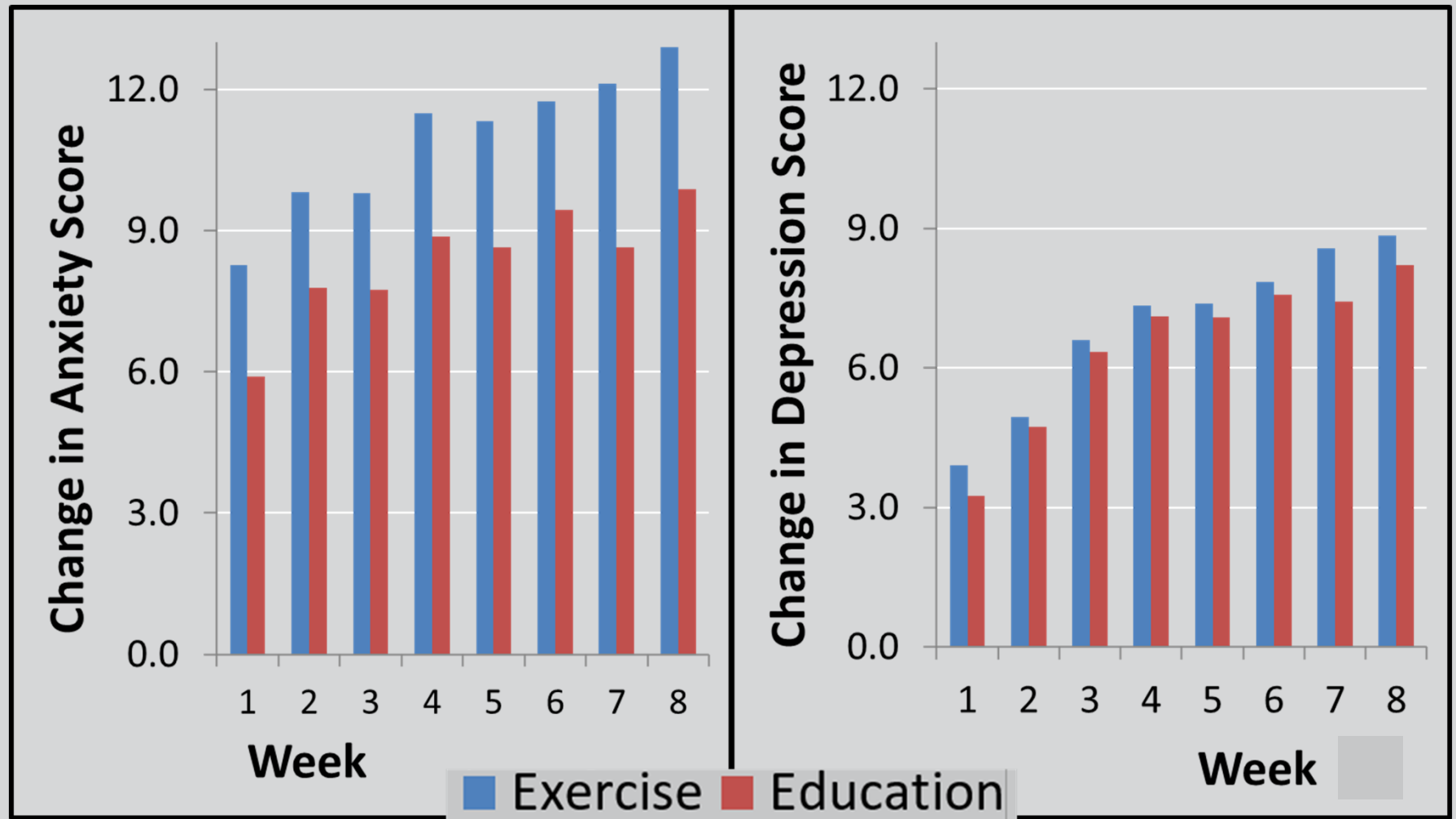
SOURCES: Reback et al., 2014;
Shoptaw et al., 2005



Does Exercise Improve Outcomes Post-Treatment?

- Yes!
- Fewer exercise participants returned to meth use compared to the education participants at 1-, 3-, and 6-months post-discharge (not statistically significant)
- Significant interaction found for self-reported meth use and meth urine drug test results – lower severity users in the exercise group reported using meth significantly fewer days at the three post-discharge time points than lower severity users in the education group
- Lower severity users in the exercise group also had a lower percentage of positive urine results at the three time points than the lower severity users in the education group (relationships not seen in higher severity groups)

The Impact of Exercise on Depression and Anxiety Symptoms



SOURCE: Rawson et al., 2015

SAMHSA's Guiding Principles of Recovery



SOURCE: US DHHS, SAMHSA, 2012

Responding to the Impact of Long-Term Stimulant Use

- Awareness of the challenges of early recovery
 - Overloading people with paperwork or complex tasks
- Patience with the healing process for each individual
 - From themselves
 - From behavioral health community
 - From family and friends



Concluding Thoughts



- The availability and use of cocaine and methamphetamine is widespread across the U.S. and beyond
- Central nervous system stimulants effect multiple organ systems, including the brain, heart, lungs, kidneys, liver, and skin
- The brain does have the ability to heal from use of stimulants, it just takes time
- A variety of behavioral interventions have been shown to be effective
- No FDA-approved medications exist (yet)
- Recovery is possible

Resources for Continued Learning



- ATTC Network's Focus on Stimulant Misuse Web Page:
<https://attcnetwork.org/centers/global-attc/focus-stimulant-misuse>
- Evidence-Based Resource Guide Series: Treatment of Stimulant Use Disorders:
<https://store.samhsa.gov/product/Treatment-of-Stimulant-Use-Disorder/PEP20-06-01-001>
- Northwest ATTC's Contingency Management for Healthcare Settings Self-Paced Online Course:
<https://healthknowledge.org/course/search.php?search=Contingency+Management>

Stimulant 101 National Curriculum



- Core Daylong Curriculum
- Condensed Three-Hour Virtual Overview
- 70-minute Keynote Presentation
- Supplemental Modules
 - Child welfare issues, gender differences, stimulant use in the context of polysubstance use, rural vs. urban differences, methamphetamine use and HIV among MSM, stimulants and HIV, and recovery approaches
- Culture Modules
 - Stimulant Use in African American, American Indian/Alaska Native, and Latinx Populations

ATTC Stimulant Workgroup Members



Co-Chairs

- Thomas E. Freese, Region 9
- Jeanne Pulvermacher, Region 5
- Beth A. Rutkowski, Region 9

Members

- James Campbell, Region 4
- Bryan Hartzler, Region 10
- Holly Ireland, Region 3
- Laurie Krom, Lena Marceno, and Viannella Halsall, ATTC NCO
- Mary McCarty-Arias, Region 2
- Maureen Nichols, Region 6
- Nancy Roget, Region 8

Thank You For Your Time

- For questions, please contact Beth (brutkowski@mednet.ucla.edu) or Thomas (tfreese@mednet.ucla.edu)
- The various components of the ATTC Stimulant 101 curriculum will be posted in fall 2020 to <https://attcnetwork.org/centers/global-attc/focus-stimulant-misuse>
- For additional information regarding SUD treatment-related Training/TA, please visit: <http://www.attcnetwork.org>
- For additional information regarding HIV/AIDS-related Training/TA, please visit: <https://aidsetc.org/>