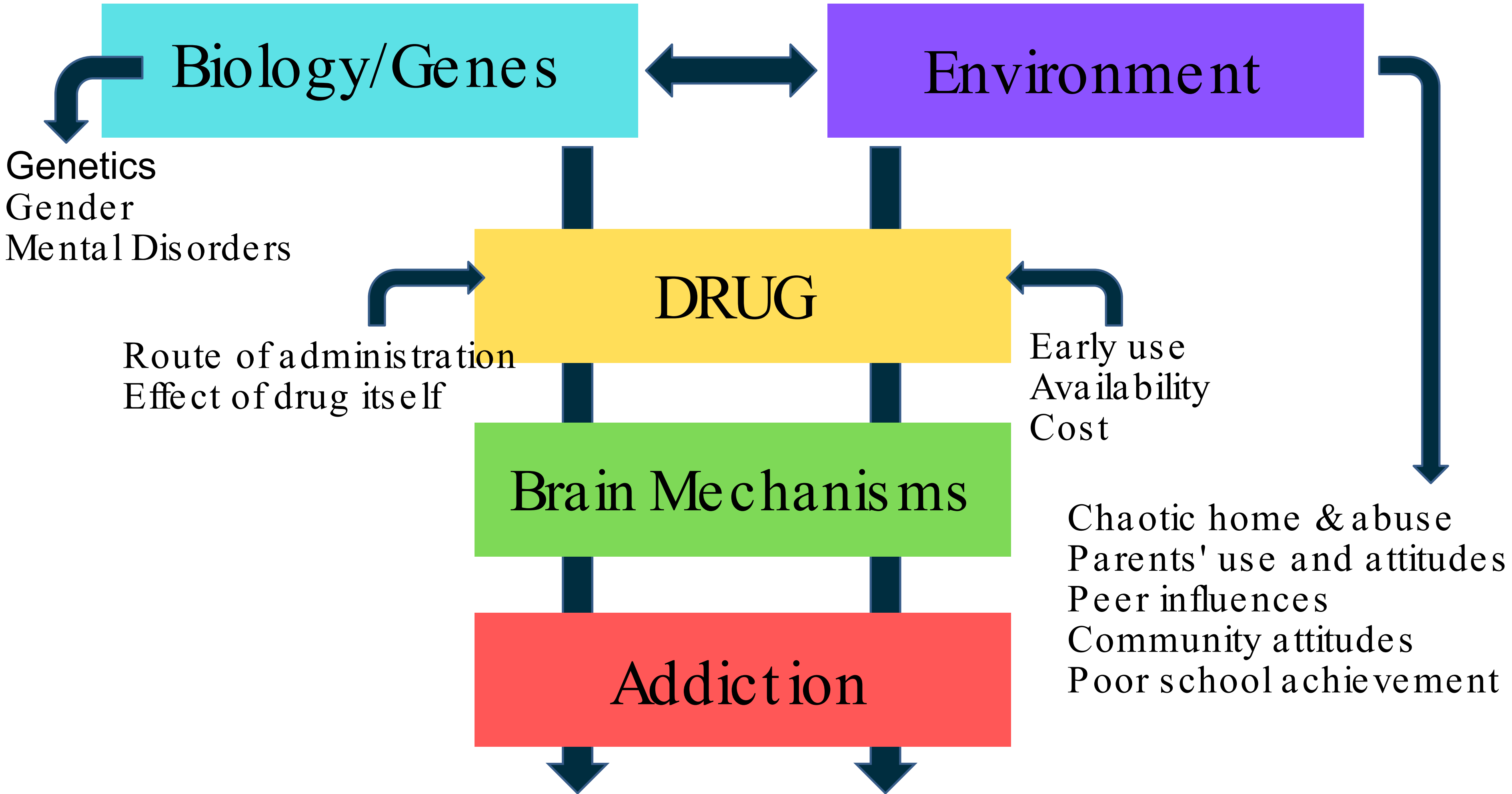


Psychopharmacology & Addiction

Presented by Dr. Kenneth Robinson, Ed.D.

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Addiction

- A state in which an organism engages in a compulsive behavior
 - Behavior is reinforcing (rewarding or pleasurable)
 - Loss of control in limiting intake

Addiction is a developmental disease - typically beginning in childhood or adolescence

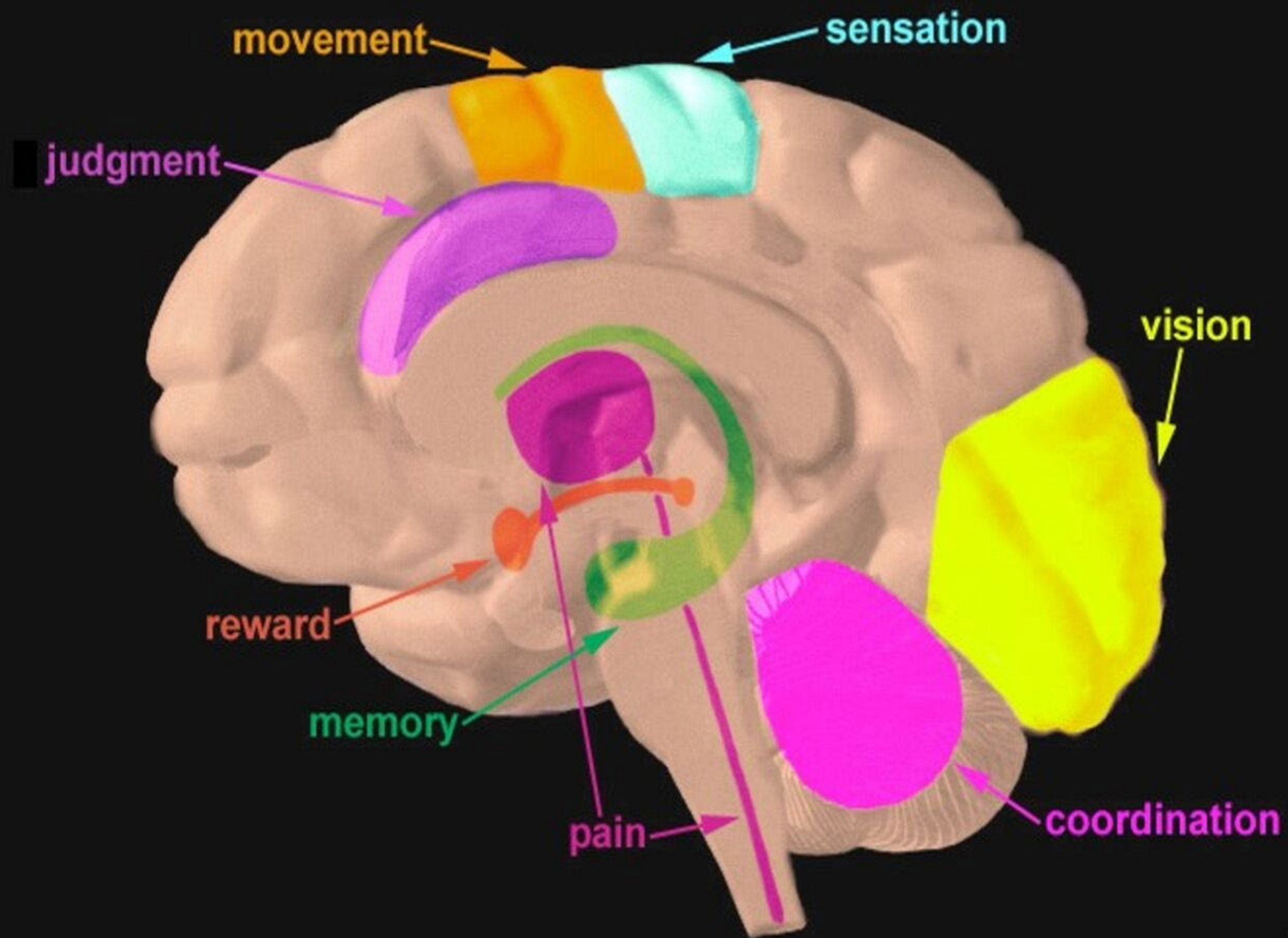
One of the brain areas still maturing during adolescence is the prefrontal cortex - the part of the brain that enables us to assess situations, make sound decisions, and keep our emotions and desires under control.

The fact that this critical part of an adolescent's brain is still a work-in-progress puts them at increased risk for poor decisions (such as trying drugs or continued abuse).

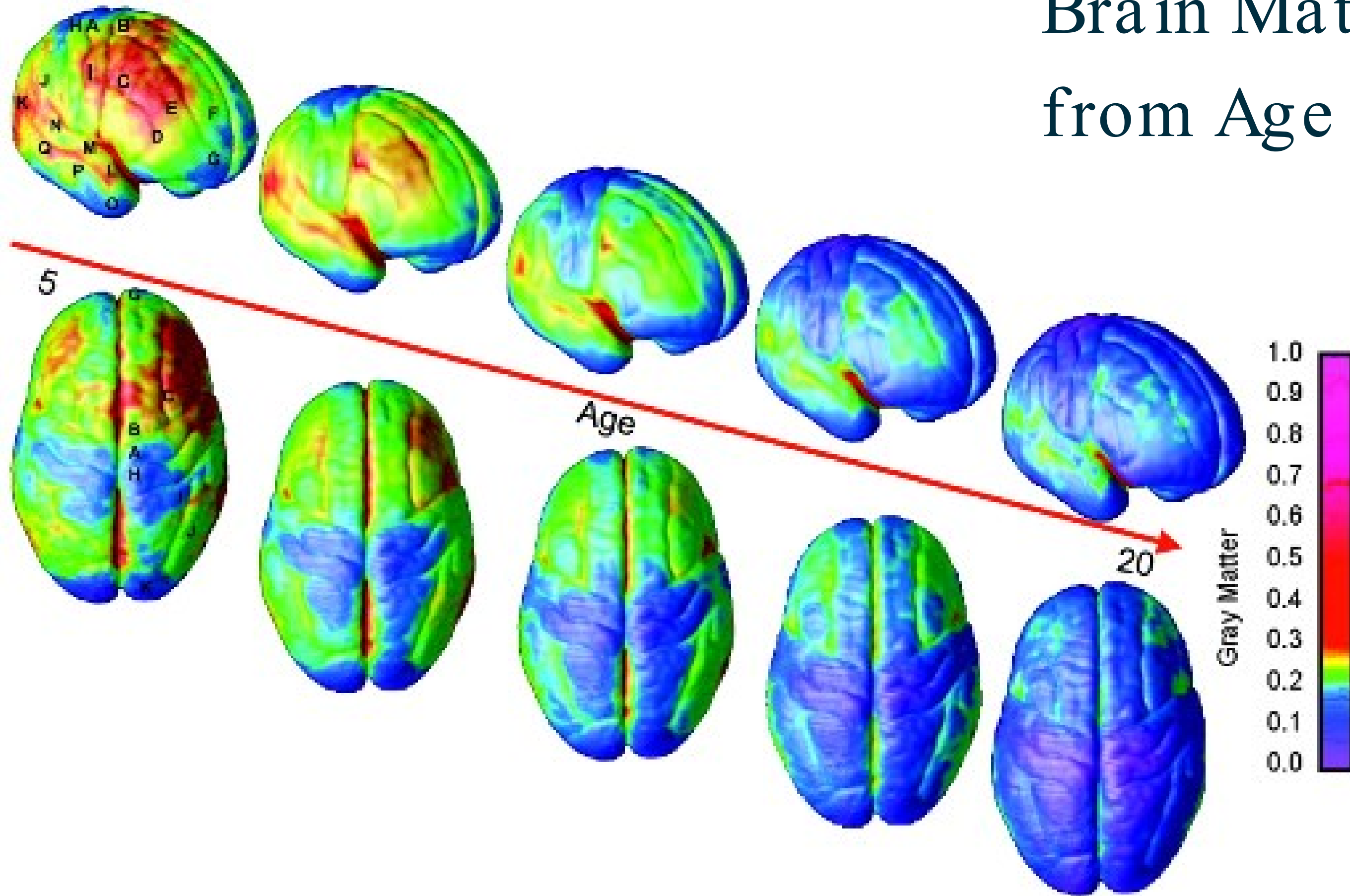
Simple Brain Structure

- Frontal Lobe (Cortex)
 - Judgment and reason
- Mid brain (Limbic)
 - Emotions and reward sites
- Hind brain (Stem)
 - Bodily functions





Brain Maturation from Age 5 to 20



Neurotransmitters

- Serotonin
 - Affects sleep and dreams - is thought to be how LSD works and is increased by the use of cocaine and amphetamine
- Dopamine
 - Affects motor movement, is involved in pleasure and is related to psychosis
- Norepinephrine
 - Affects heart rate, blood pressure, sweating, dilates pupils, lungs and constricts blood vessels

Neurotransmitters

- GABA (gamma amino butyric acid)
 - Inhibits cells from firing, much of the following drugs gain their effects through this neurotransmitter
 - alcohol,
 - barbiturates,
 - benzodiazepines
- Acetylcholine (ach)
 - It is at every axon - nicotine tends to work through this neurotransmitter
- Endorphins
 - Body's natural pain killers

NATURAL REWARDS

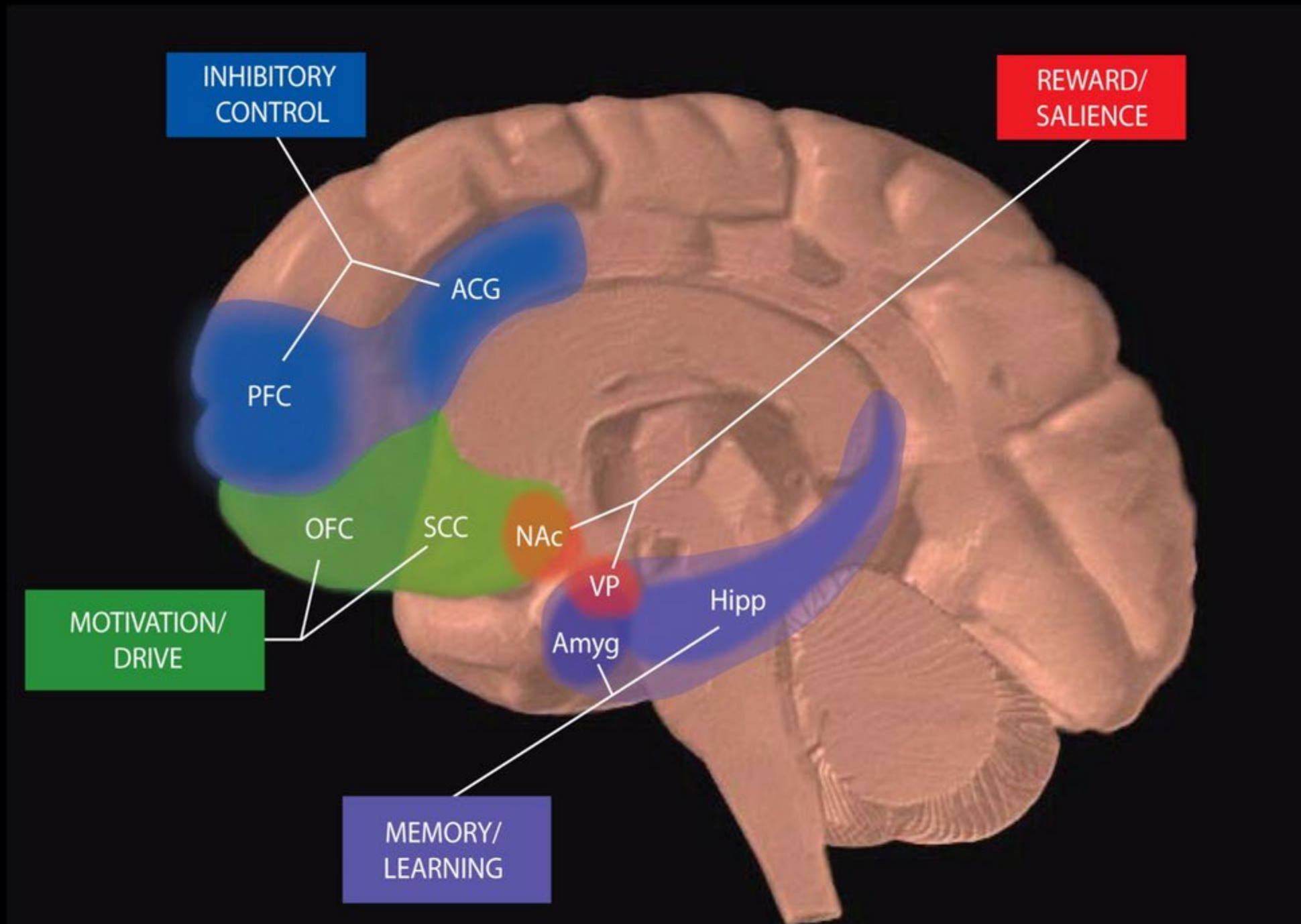
Food

Water

Sex

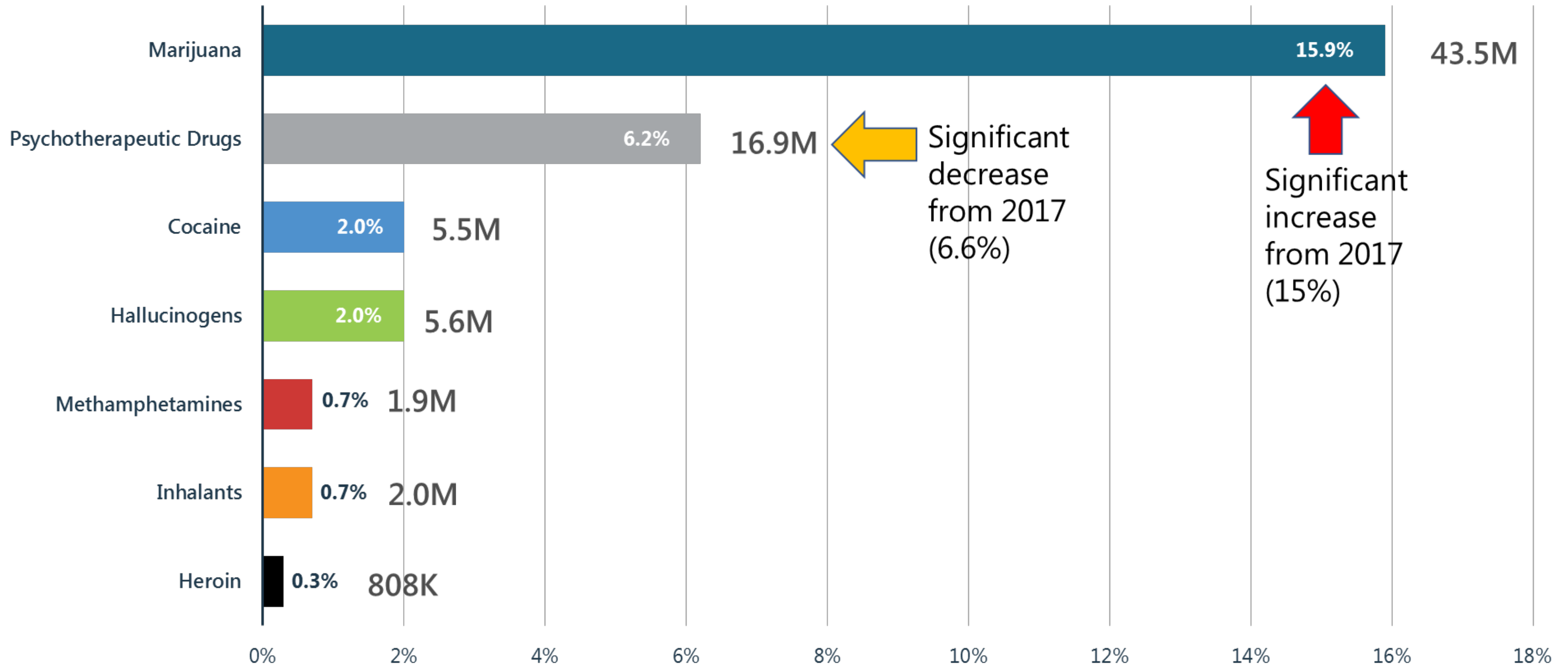
Nurturing

Circuits Involved In Drug Abuse and Addiction

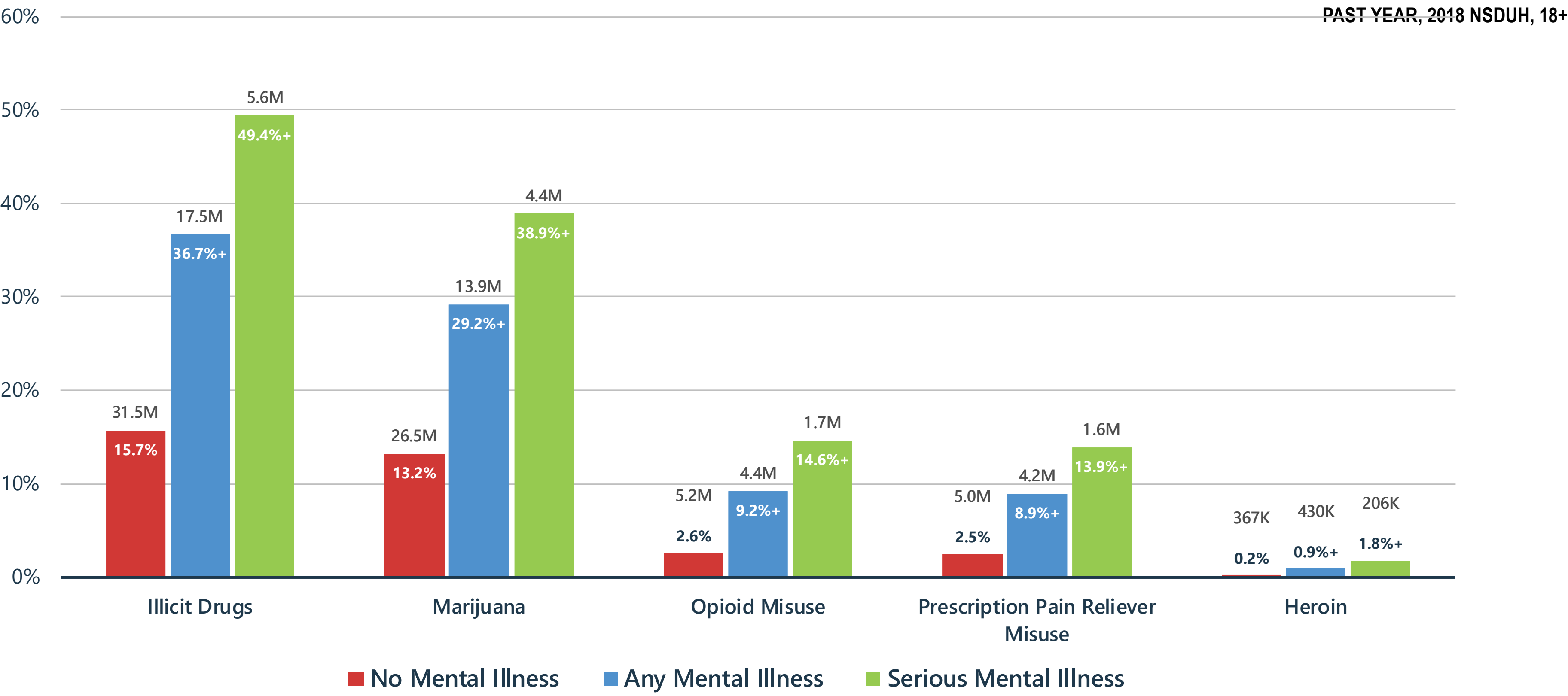


**All of these must be considered
in developing strategies to
effectively treat addiction**

Illicit Drug Use: Marijuana Most Used Drug



Co-Occurring Issues: Substance Use Is More Frequent among Adults (≥18 y.o.) with Mental Illness

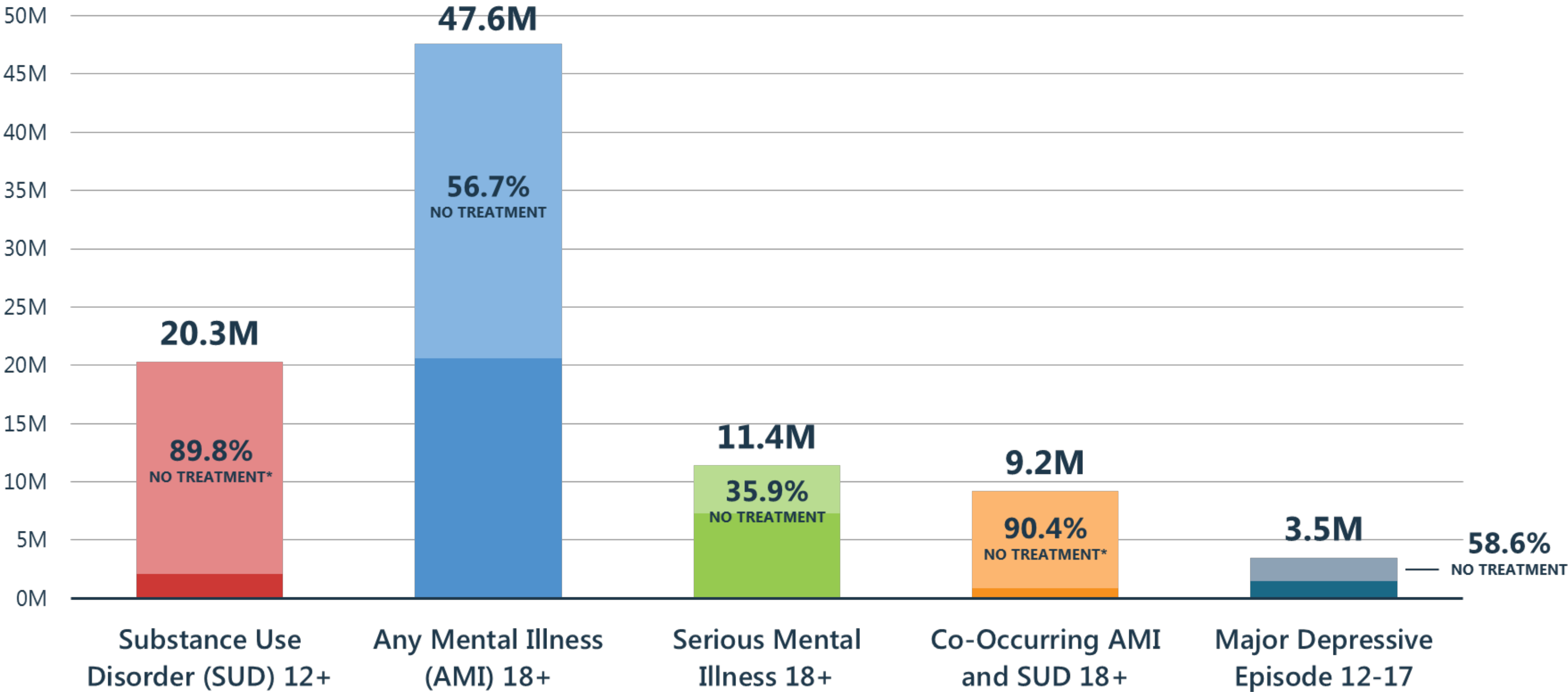


+ Difference between this estimate and the estimate for adults without mental illness is statistically significant at the .05 level.



Despite Consequences and Disease Burden, Treatment Gaps Remain Vast

PAST YEAR, 2018 NSDUH, 12+

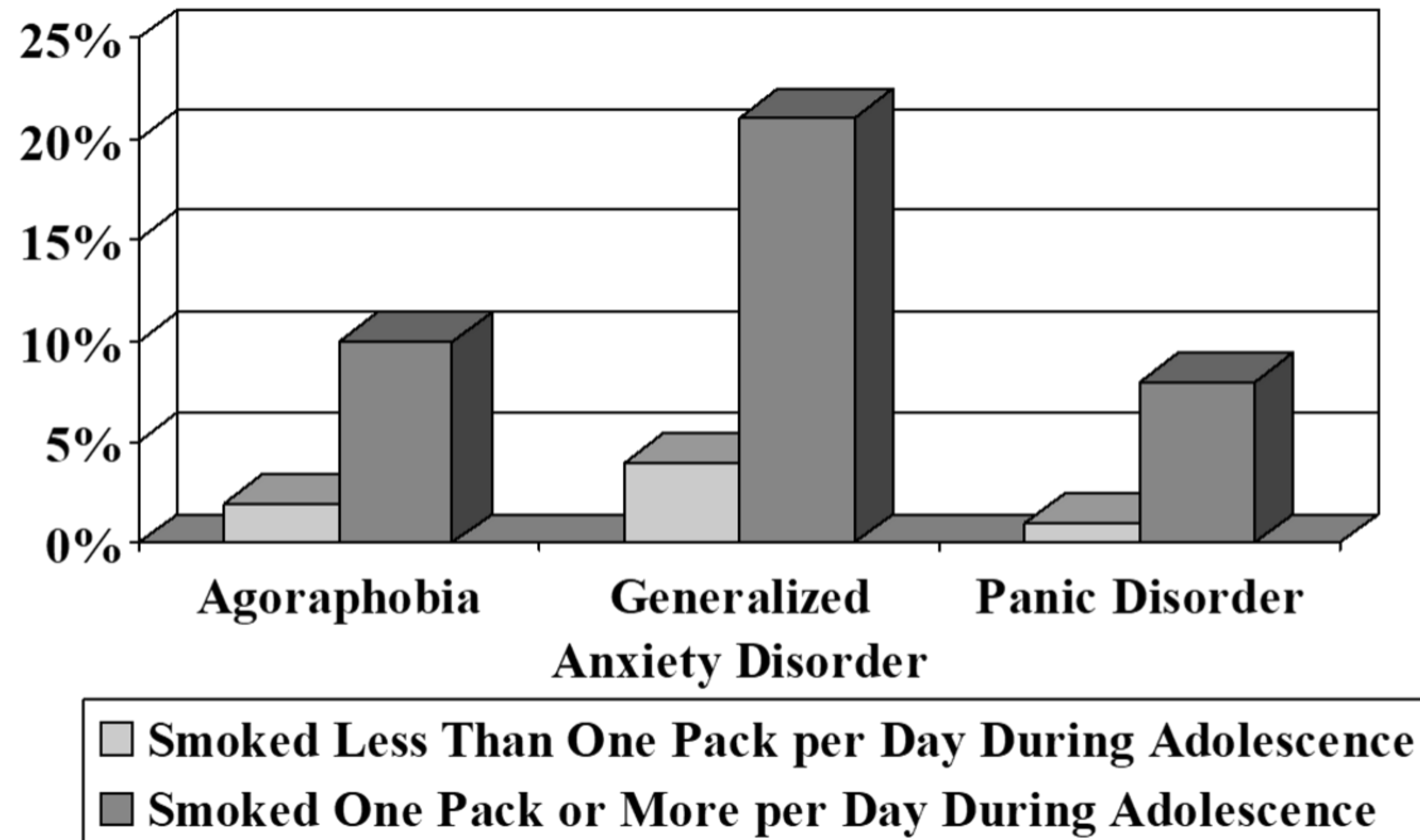


*No Treatment for SUD is defined as not receiving treatment at any location, such as a hospital (inpatient), rehabilitation facility (inpatient or outpatient), mental health center, emergency room, private doctor's office, self-help group, or prison/jail.



NICOTINE & TOBACCO

Percentage of Young Adults With Anxiety Disorders, by Amount of Cigarettes Smoked During Adolescence

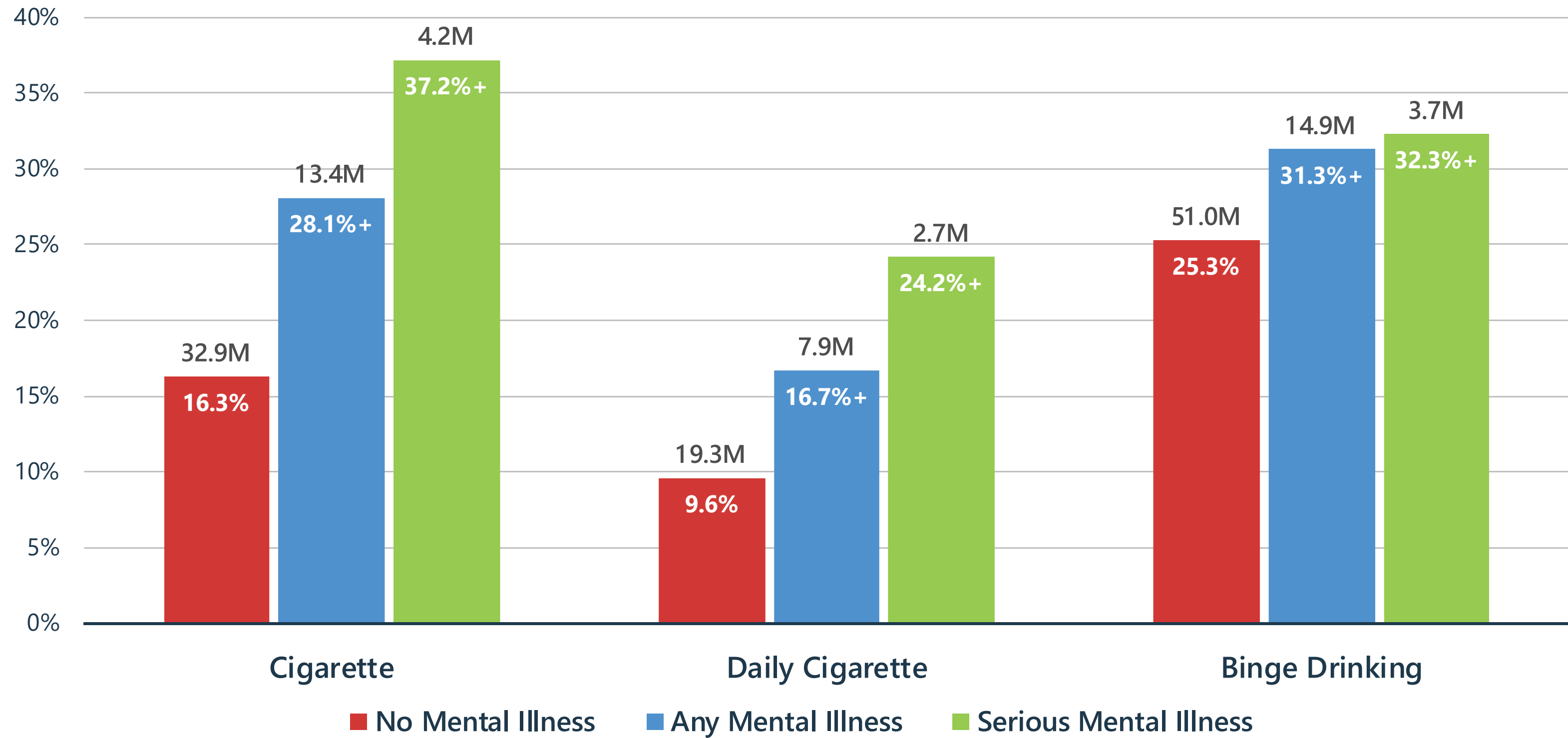


Source:

Adapted by CESAR from Johnson J.G., Cohen P., Pine D.S., Klein D.F., Kasen S., Brook J.S., "Association Between Cigarette Smoking and Anxiety Disorders During Adolescence and Early Adulthood," Journal of the American Medical Association 284(18):2348-2351, 2000.

Co-Occurring Issues: Smoking & Binge Drinking more frequent among Adults (≥18 y.o.) with Mental Illness

PAST MONTH, 2018 NSDUH, 18+



+ Difference between this estimate and the estimate for adults without mental illness is statistically significant at the .05 level.

Impact of Smoking and Alcoholism on Brain Neurobiology and Function

- Researchers said that smoking may affect a key amino acid (GABA) in the brain, meaning that drug therapy for alcohol withdrawal may have different effects on smokers than nonsmokers.
- Scientists also reported that MRI studies have shown that smoking makes alcohol-induced brain-tissue loss and neuronal injury worse among alcoholics who have recently detoxed.
- “Our analysis showed that chronically smoking alcoholics have less brain tissue measured by structural MRI, and more neuronal injury measured by MRSI—at the beginning of their treatment for alcoholism than nonsmoking alcoholics,” said Meyerhoff.

Nicotine and Increased Dependence on Cocaine

- An epidemiological analysis suggested that most people who initiate cocaine use do so as current cigarette smokers, and therefore incur this increased risk.
- National Epidemiological Study of Alcohol Related Consequences (NESARC), shows that the prevalence of cocaine dependence was 20 percent among respondents who were current smokers when they initiated cocaine use, and 6 percent among respondents who had never smoked or had stopped smoking before they first took cocaine.

Source: NIDA 2013

Cessation Concurrent with Mental Health or Addictions Treatment

- Smoking cessation has no negative impact on psychiatric symptoms and smoking cessation may even lead to better mental health and overall functioning
- Participation in smoking cessation efforts while engaged in other substance abuse treatment has been associated with a 25 percent greater likelihood of long-term abstinence from alcohol and other drugs

Source: Baker et al., 2006; Lawn & Pols, 2005; Morris et al., Unpublished data; Prochaska et al., 2008; Bobo et al., 1995; Burling et al., 2001; Hughes, 1996; Hughes et al., 2003; Hurt et al., 1993; Pletcher, 1993; Prochaska et al., 2004; Rustin, 1998; Saxon, 2003; Taylor et al., 2000

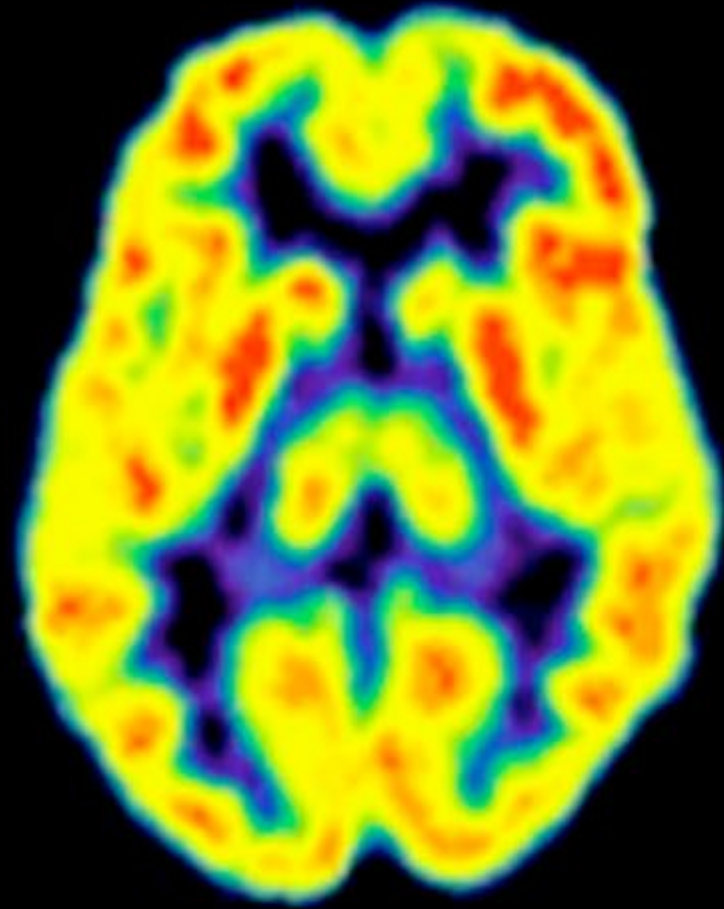


ALCOHOL

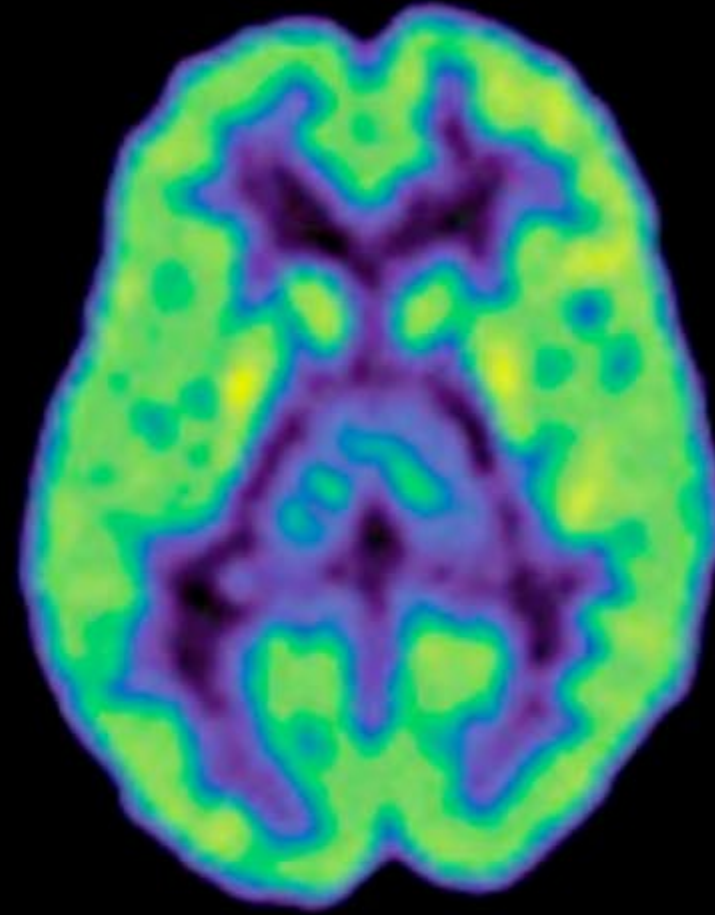
Alcohol

- Areas of the brain involved
 - Most areas of the brain
 - Causes number of GABA receptors to physically increase
 - Affects endorphin receptors, allowing for intoxication
 - Naltrexone blocks receptors
 - Reduces serotonin - relates to blackouts
 - Activates dopamine - chronic use decreases

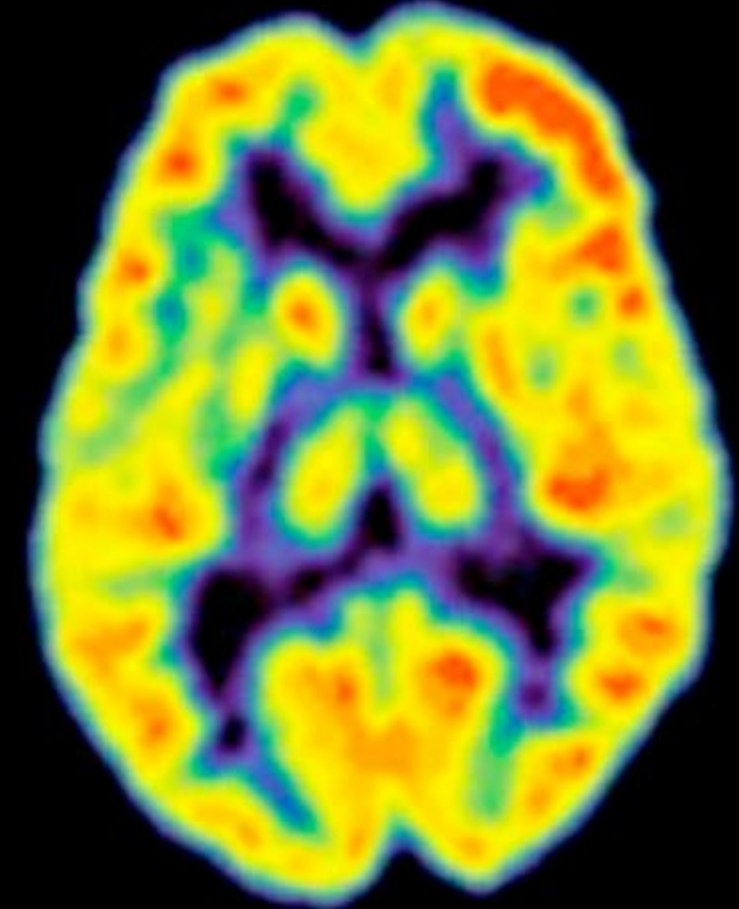
Alcohol makes the alcoholic brain 'normal'



control



alcoholic



**intoxicated
alcoholic**

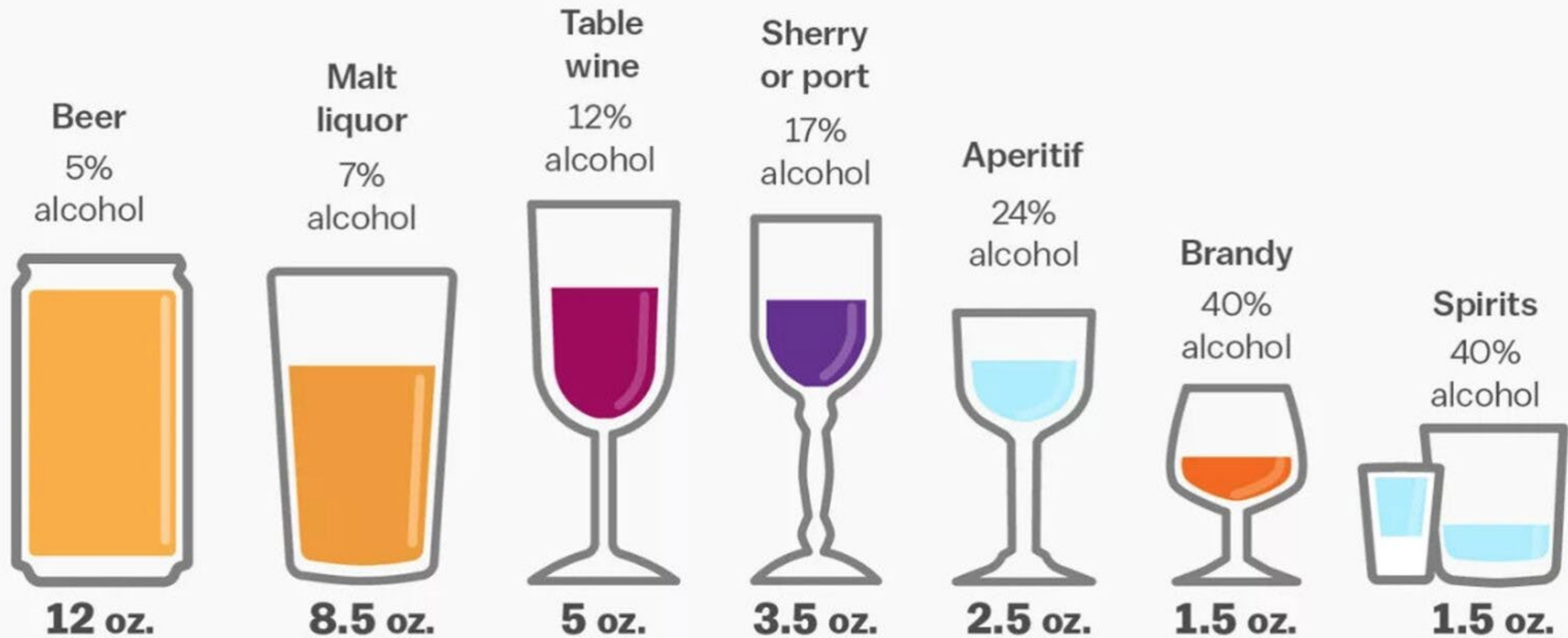
Alcohol

- **Blood Alcohol Levels:**

- .1 % BAL motor coordination is impaired
- .2 % BAL user is obviously intoxicated
- .3 % BAL physical and mental activity decreases as user enters a stupor
- .35 % BAL anesthesia is present
- .4 % BAL most die from respiration cessation
- .6 % BAL most are dead

This is what one drink looks like

According to the Dietary Guidelines for Americans, moderate drinking is up to one drink per day for women and up to two drinks per day for men. A standard drink contains 14 grams of pure alcohol.



Measures are approximate, since different brands and beverages may vary in their actual alcohol content.

Photo
credit:

Vox

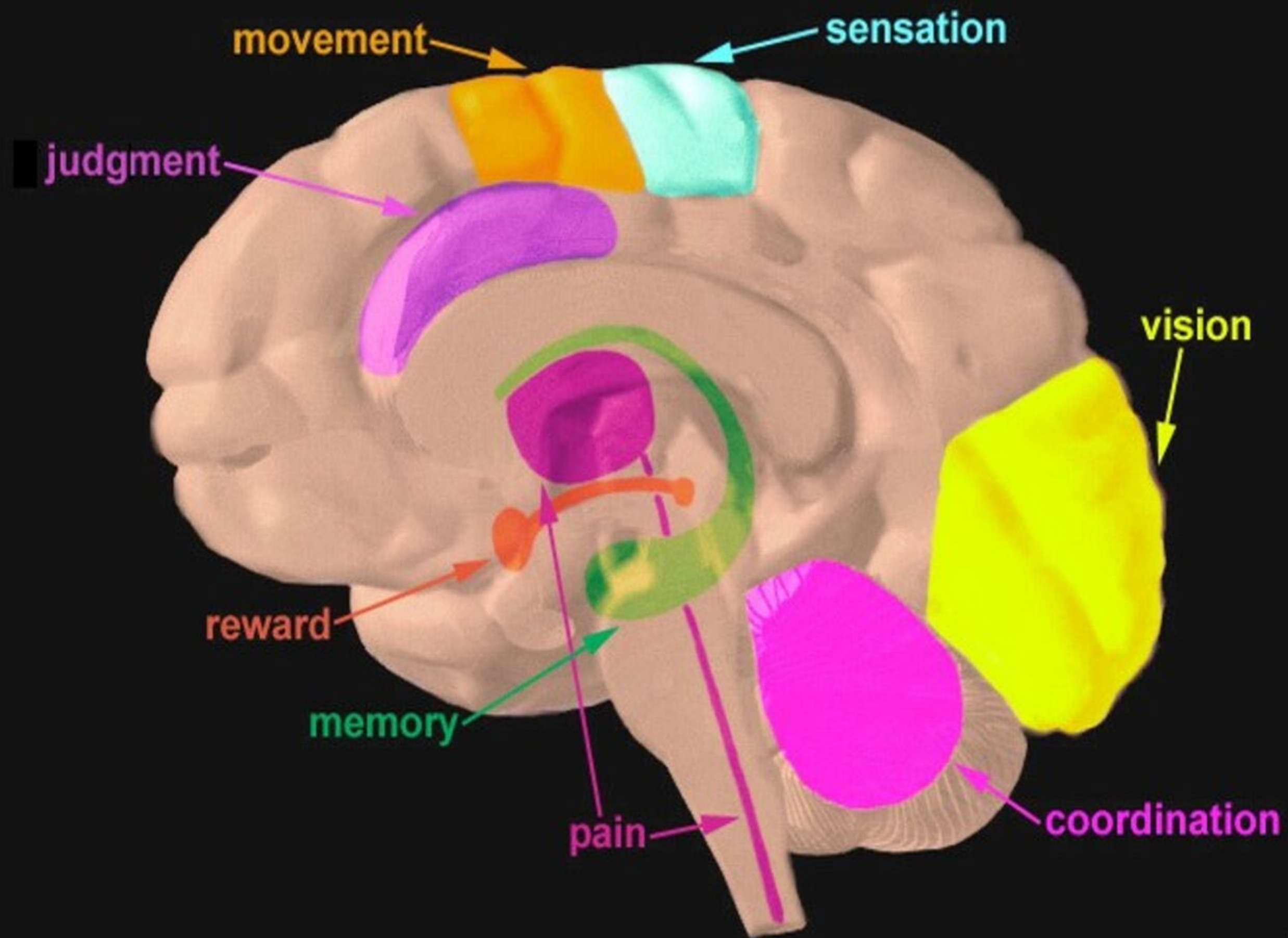
Gender Differences

- Abuse of Alcohol:
 - Female 7%, Male 20%
- However— Females develop dependence quicker, brain atrophy & liver damage more quickly
- Why women?
 - Tend to weigh less
 - Have less water & more fatty tissue (fat retains alcohol & water dilutes it)
 - Women also have lower levels of alcohol dehydrogenase and aldehyde dehydrogenase that breakdown alcohol in liver and stomach, thus more absorbed in bloodstream.

Research Findings

- Alcohol damages dopamine reward cycle by first increasing then decreasing at chronic levels in the nucleus accumbens and hippocampus.
- Normal 8-10% of family develop alcoholism - one parent increases risk to 20-28% - thus increasing risk two-three times.

Source: *Journal of Alcoholism: Clinical & Experimental Research* Nov. 99



Brain Damage from Heavy Social Drinking

- Heavy drinking – defined as follows:
 - 100 drinks for males & 80 for females per month
- Brain damage detectable in scans even those not in treatment – enough to impair day to day functioning (reading, balance, etc.)

Source: *Alcoholism: Clinical & Experimental Research* April 2004 Meyerhoff et al.

Alcohol Impairs Cognitive Skills Longer than Motor Skills

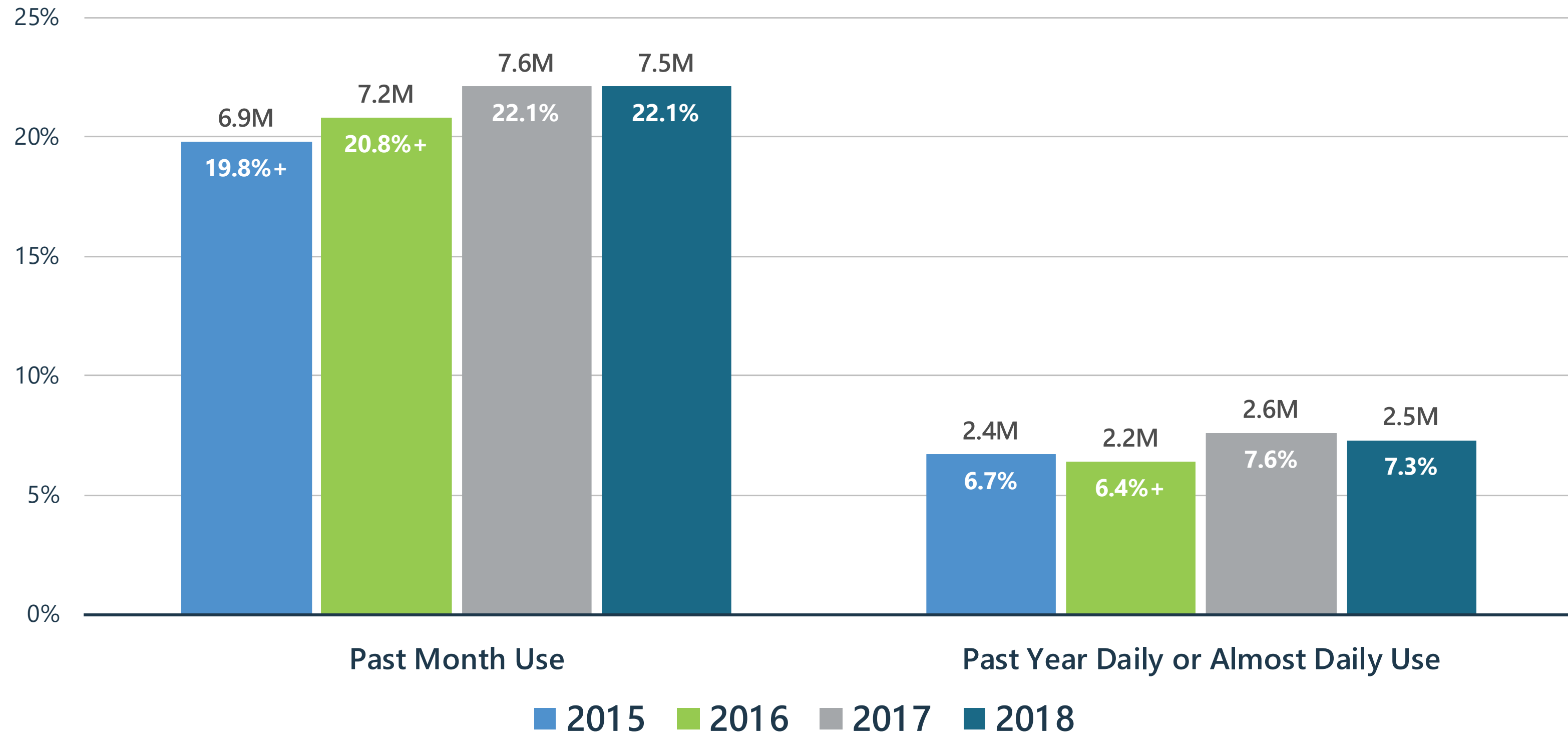
- Found that BAC rising affects cognitive skills & motor skills. Motor skills improve as BAC decreases whereas cognitive skill impairment lingers. This creates illusion of sobriety even when impairment continues.

Source: *Alcoholism: Clinical & Experimental Research* April 2004 Schweizer et al.

MARIJUANA

Marijuana Use among Young Adults (18-25 y.o.)

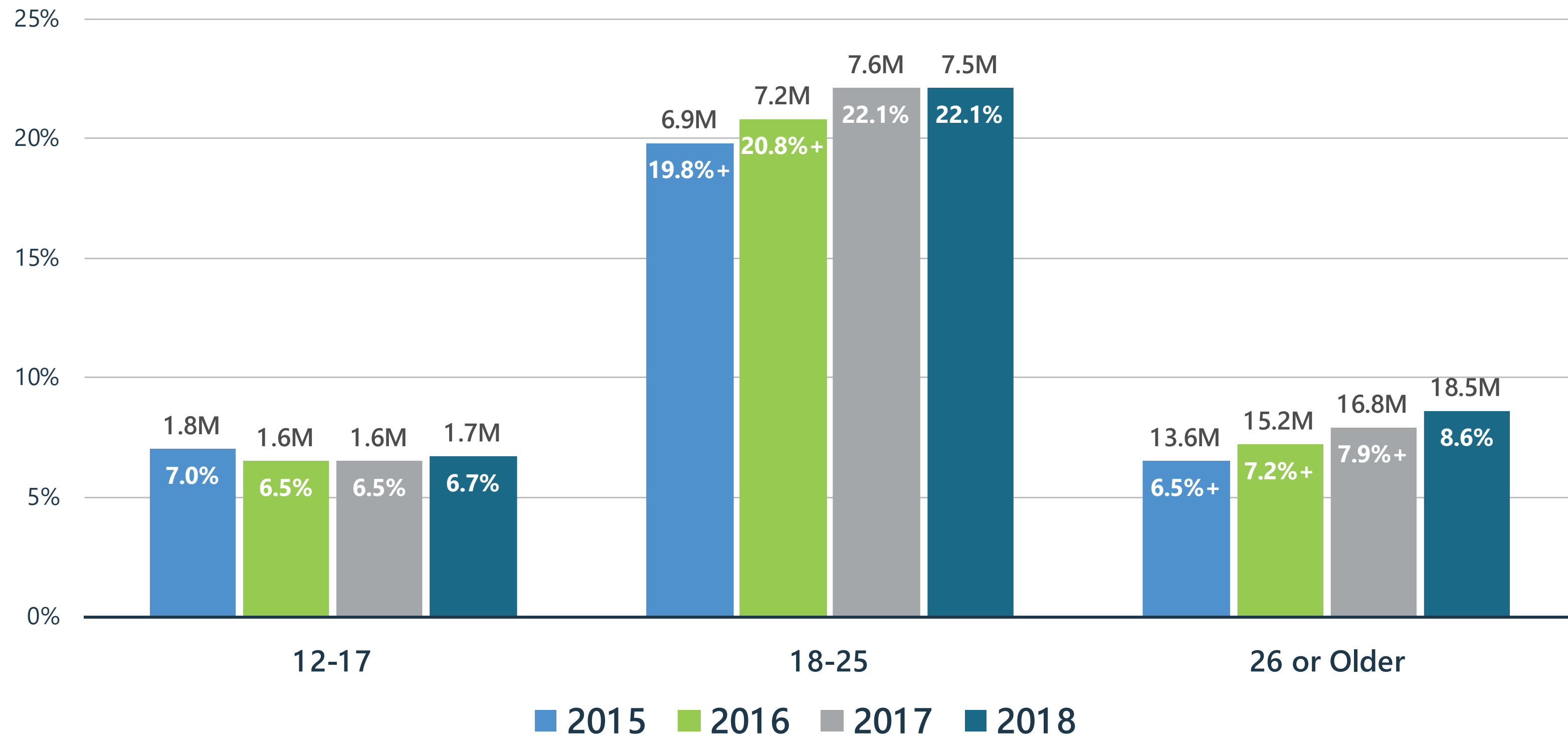
PAST MONTH/YEAR, 2015-2018 NSDUH, 18-25



+ Difference between this estimate and the 2018 estimate is statistically significant at the .05 level.

Marijuana Use

PAST MONTH, 2015-2018 NSDUH, 12+



+ Difference between this estimate and the 2018 estimate is statistically significant at the .05 level.

Areas of the Brain Involved:

- Affects hippocampus
 - leading to impairment of short-term memory
- Affects cerebellum
 - affecting movement
- Affects hypothalamus
 - affecting appetite and eating

Drivers of Brain Aging






In the largest known brain imaging study, scientists from Amen Clinics, Google, John's Hopkins, UCLA, and UC San Francisco evaluated **62,454 brain SPECT scans** of individuals from nine months old to 105 years of age to investigate factors that accelerate brain aging.



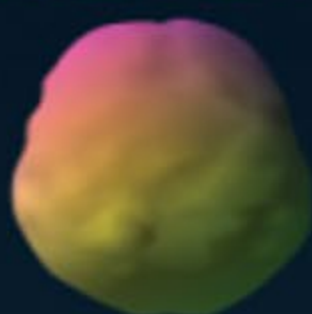
128
brain
regions

studied to predict
the chronological
age of a patient

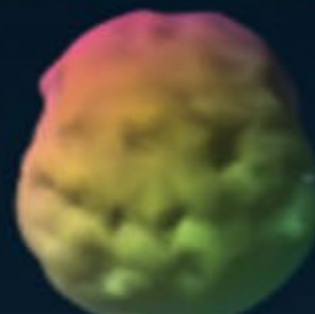
Accelerated Aging Prediction

	Schizophrenia	4 years
	Cannabis Abuse	2.8 years
	Bipolar Disorder	1.6 years
	ADHD	1.4 years
	Alcohol Abuse	0.6 years

Aging
SPECT
scans



Age 20



Age 50



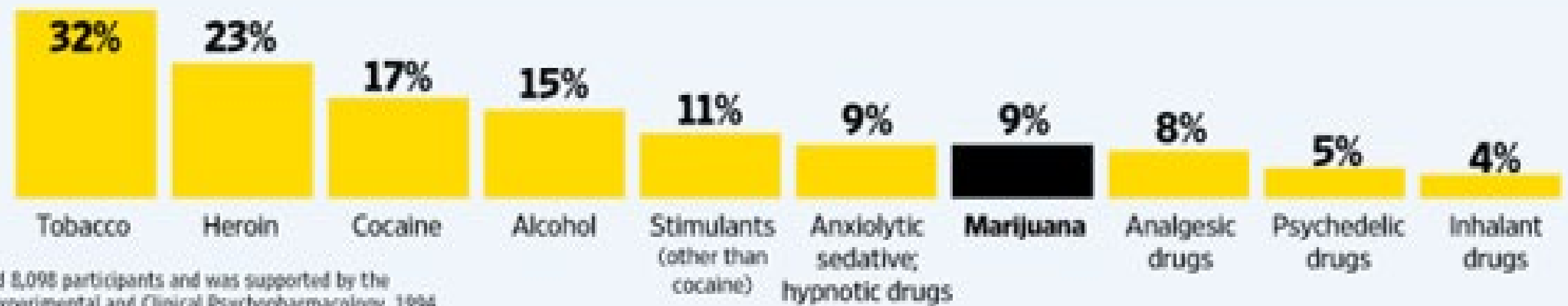
Age 80

"We can now link clinical diagnoses and addictions to premature aging of the brain. Better treatment of these disorders can slow or even halt brain aging."

The cannabis abuse result was especially important, as our culture is starting to view marijuana as a harmless substance. These findings invite us to rethink its effects on the brain."

~ Daniel G. Amen, MD, founder of Amen Clinics

Estimated percentage of people in a national survey who used a substance at least once and became dependent



Source: The National Comorbidity Survey, which included 8,098 participants and was supported by the National Institute on Drug Abuse; results published in *Experimental and Clinical Psychopharmacology*, 1994

Marijuana Addiction

- Early heavy users & steady increasers more likely to use other drugs and hamper education and earnings capacity.
- Occasional light users (those who use less than 10 times a year and started after 13) are least likely to suffer detriments but did exhibit slight losses when compared to abstainers.

Source: Ellickson et al. NIDA Notes Vol 19 # 5, Jan 2005.; Fergusson et al.

“A shift from brain systems
controlling reward-driven use to
habit-driven use differentiates
heavy cannabis users who are
addicted to the drug from users
who aren’t.”

“Although all of the cannabis users in the study reported heavy use, only some were dependent on the drug. Both dependent and non-dependent cannabis users had exaggerated responses in a brain region that processes reward—the ventral striatum—compared with people who didn't use cannabis. Interestingly, the dependent users also had larger responses in a brain region that forms habits—the dorsal striatum.”

“Addictive use may rather be driven by changes in brain systems that promote habitual—automatic—use, which also may explain the fact that addicts continue use despite a lack of experiencing rewarding effects of the drug. As such, their behavior has become under the control of the drug cues, rather than the actual reward expectation,” said lead author Benjamin Becker, PhD.

The findings help explain how the brain becomes dependent on cannabis, and why not all cannabis users develop an addiction, even with long-term regular use.

Facts about Marijuana

- Marijuana also affects memory, learning, and motor functions. These impairments may last up to 30 days and therefore people may make poor judgements, or have motor impairment long after the high is gone. Therefore could affect a wide range of tasks.

Recent Findings

- The psychoactive ingredient in marijuana-THC-has increased almost six-fold in average potency during the past 30 years
- Marijuana use during adolescence is directly linked to the onset of major mental illness, including psychosis, schizophrenia, depression and anxiety.

Source: Mehmedic, Z., Pharm, M., Suman, C., Slade, D., Denham, H. Foster, S., et al.
(2010) Journal of Forensic Sciences; Room, R. Fischer, B., Hall, W., Lenton, S. & Reuter, P.
(2010) Cannabis Policy: Moving Beyond Stalemate.

Short Term Effects (low doses of marijuana)

- Poor memory and ability to learn
- Dangerous driving behavior
- Difficulty thinking and solving problems
- Altered sense of time and space
- Poor muscle coordination and judgment
- Food cravings
- Short attention span

Source: CA AOC 2014

Short Term Effects (low doses of marijuana)

- Hallucinations
- Delusions
- Poor memory
- Not knowing where one is
- Anxiety attacks or feelings of paranoia
- Depression

Source: CAAOC 2014

Long Term Effects of Marijuana Use

- Cancer:
 - Marijuana contains the same cancer-causing chemicals found in tobacco smoke.
- Breathing problems
- Immune System:
 - The THC in marijuana can damage the cells and tissues in the body that help protect against disease.

Source: CA AOC 2014

Long Term Effects of Marijuana Use

- Memory, learning, and energy are impaired
- Fertility:
 - Reproductive hormones are decreased.
 - Men: less testosterone, causing decreased sperm counts and possible erectile dysfunction
 - Women: irregular periods, decreased ability to conceive

Source: CA AOC 2014

Evidence Grows that Heavy Marijuana Use May Harm Brain

- NIDA-funded research shows heavy marijuana use (at least four times per week over past six months) is linked to adverse changes in function and structure of brain areas associated with reward, decision making, and motivation.

Source: NIH November 2014

Link Between Marijuana Use, Depression, and Other Mental Health Problems

- Teens who smoke marijuana when feeling depressed are also more likely to become addicted to marijuana or other illicit drugs.
- 8% of depressed teens abused or became dependent on marijuana during the year they experienced depression, compared with only 3% of non-depressed teens.
- Overall, more teens are in treatment for marijuana dependence than for any other illicit drug.

Source: 2005 Treatment Episode Data Set (TEDS), SAMHSA, 2008

Smoking Cannabis Can Lead to Manic Behavior

- Scientists have found a significant link between marijuana use and mania (ranging from hyperactivity and difficulty sleeping to aggression, becoming delusional, and hearing voices)
- Lead researcher Dr. Marwaha of Warwick University examined the effect of marijuana on people who had experienced mania, and set out to find:
 - Does cannabis use lead to increased occurrence of mania symptoms or manic episodes in individuals with pre-existing bipolar disorder, and
 - Does cannabis use increase the risk of onset of mania symptoms in those without pre-existing bipolar disorder.

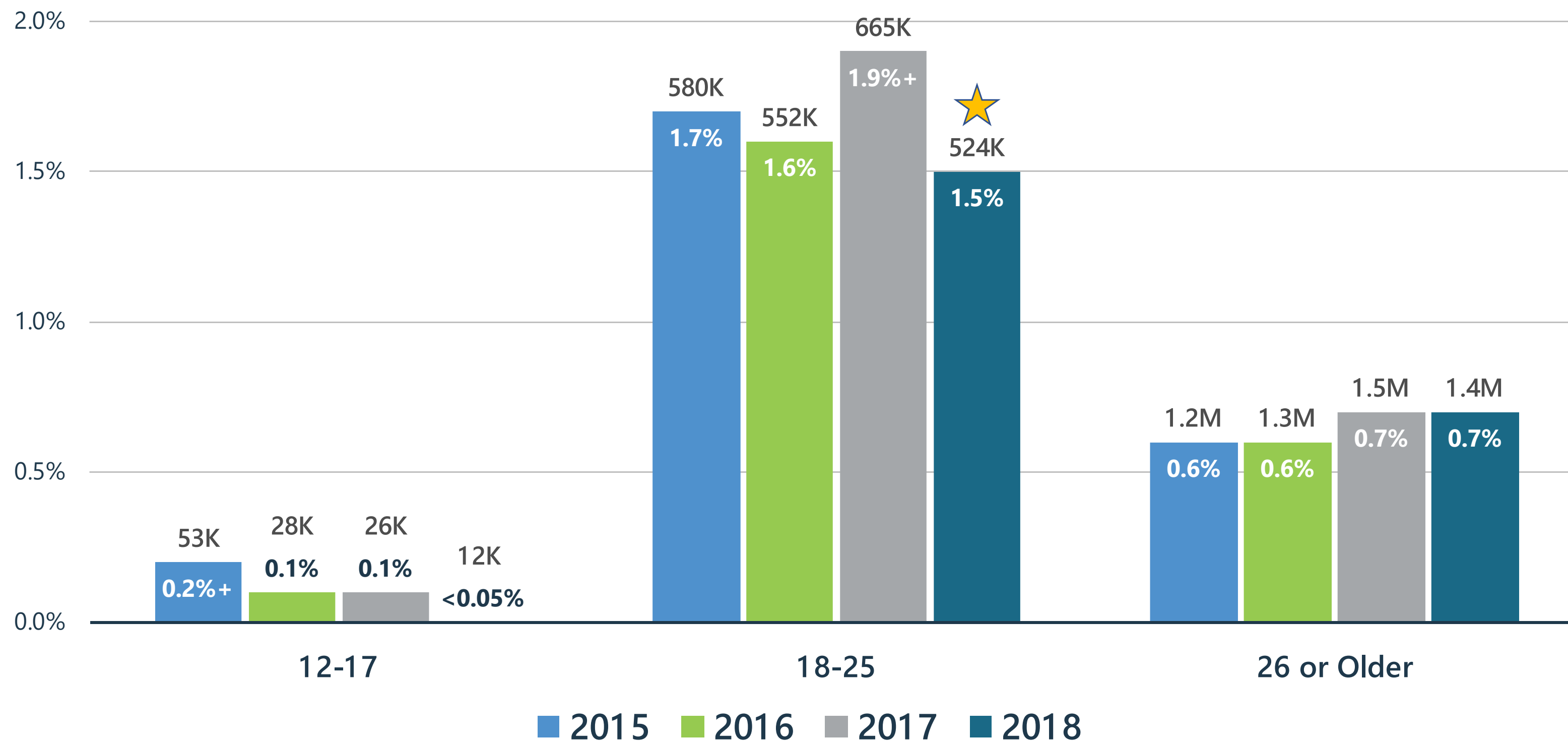
Source: M. Davies February 2015, dailymail.co.uk



COCAINE & AMPHETAMINES

Cocaine Use: Significant Decline among Young Adults (18-25 y.o.)

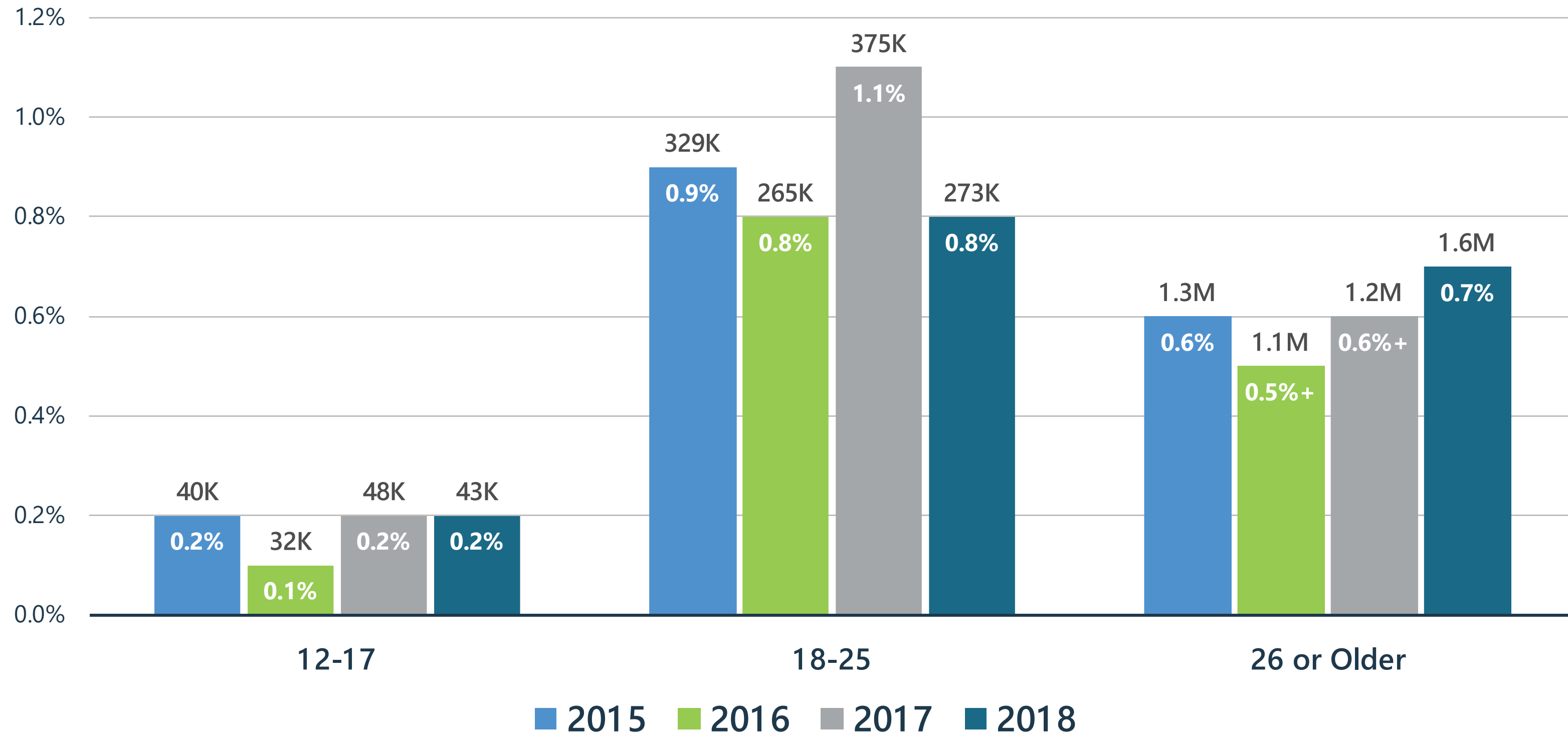
PAST MONTH, 2015-2018 NSDUH, 12+



+ Difference between this estimate and the 2018 estimate is statistically significant at the .05 level.

Methamphetamine Use: Significant Increase in Adults ≥ 26 y.o.

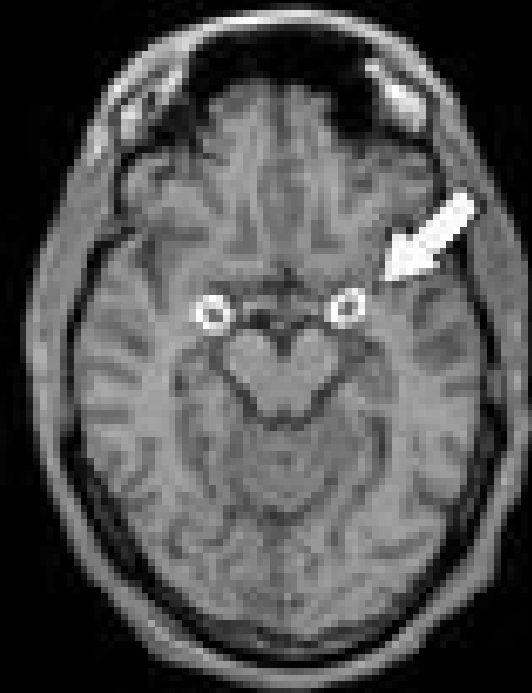
PAST YEAR, 2015-2018 NSDUH, 12+



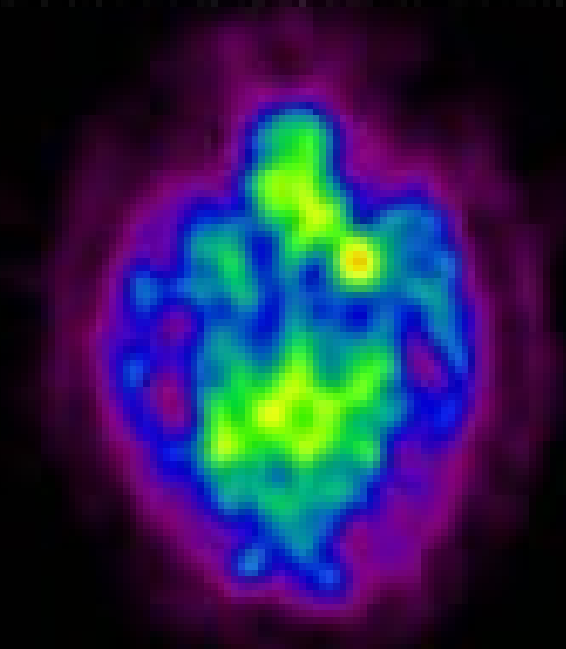
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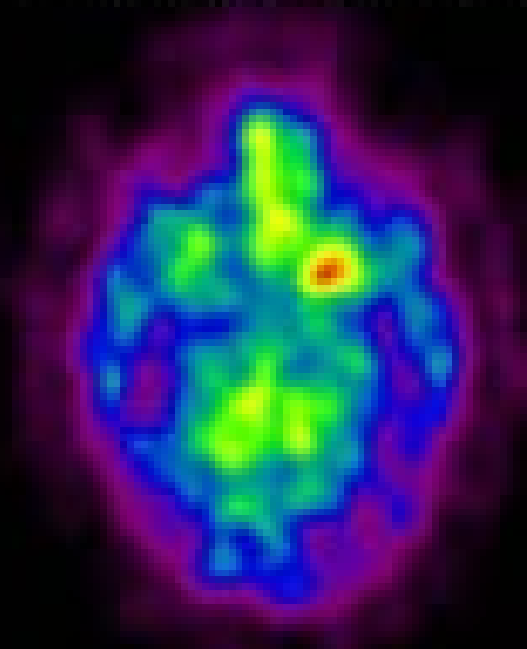
Amygdala



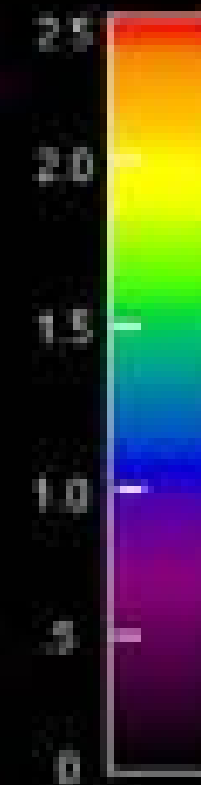
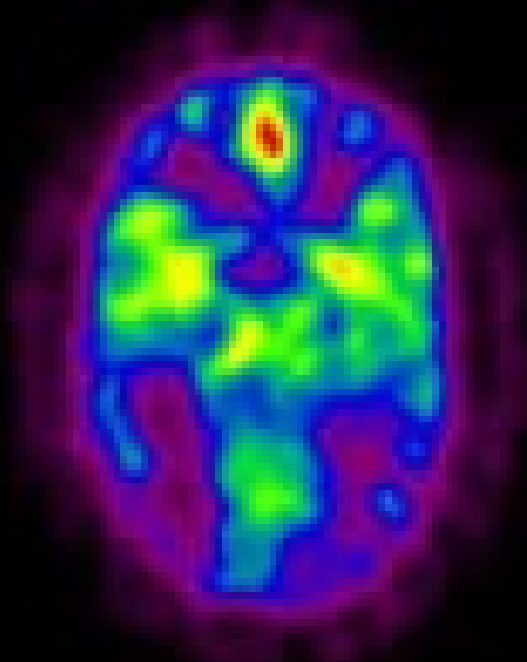
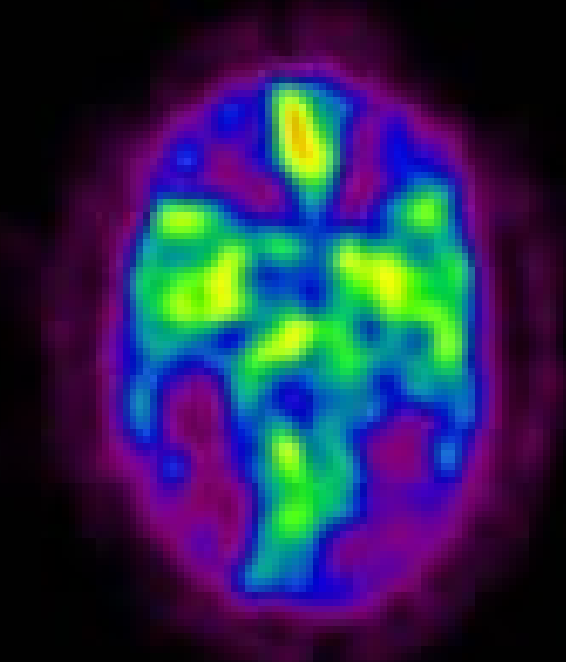
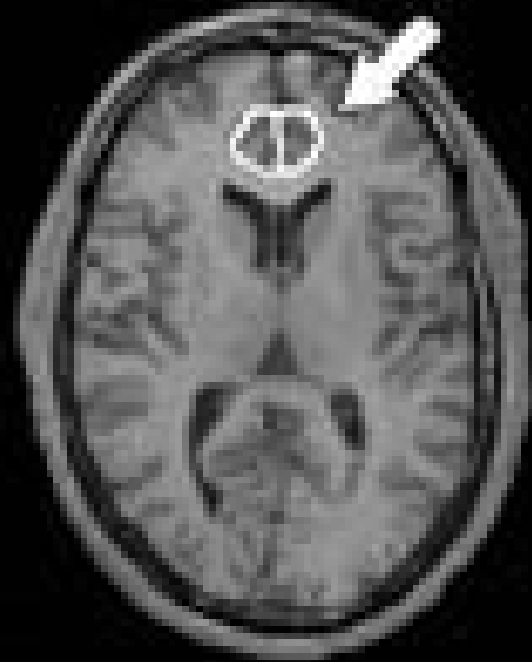
Nature Video



Cocaine Video



Anterior Cingulate



Addiction may develop much sooner than believed:

- “Even among non-dependent cocaine users, cues associated with consumption of the drug lead to dopamine release in an area of the brain thought to promote compulsive use, according to researchers.”

“The scientists created highly personalized cues by filming participants ingesting cocaine in the laboratory with a friend with whom they had used the drug before. During a later session, subjects underwent a PET scan while watching the video of their friend taking cocaine. Exposure to the cocaine-related cues increased both craving and dopamine release in the dorsal striatum.”



Cocaine Use Becoming Deadlier

- In 2017, opioids were involved in 72.7% of cocaine involved overdoses, and the data suggest that increases in cocaine -involved deaths from 2012 - 2017 were driven primarily by synthetic opioids.

Long Term Effects of Cocaine Use on Cognition

Impaired Function in:

- sustaining attention
- impulse inhibition
- memory
- making decisions involving rewards or punishments
- performing motor tasks

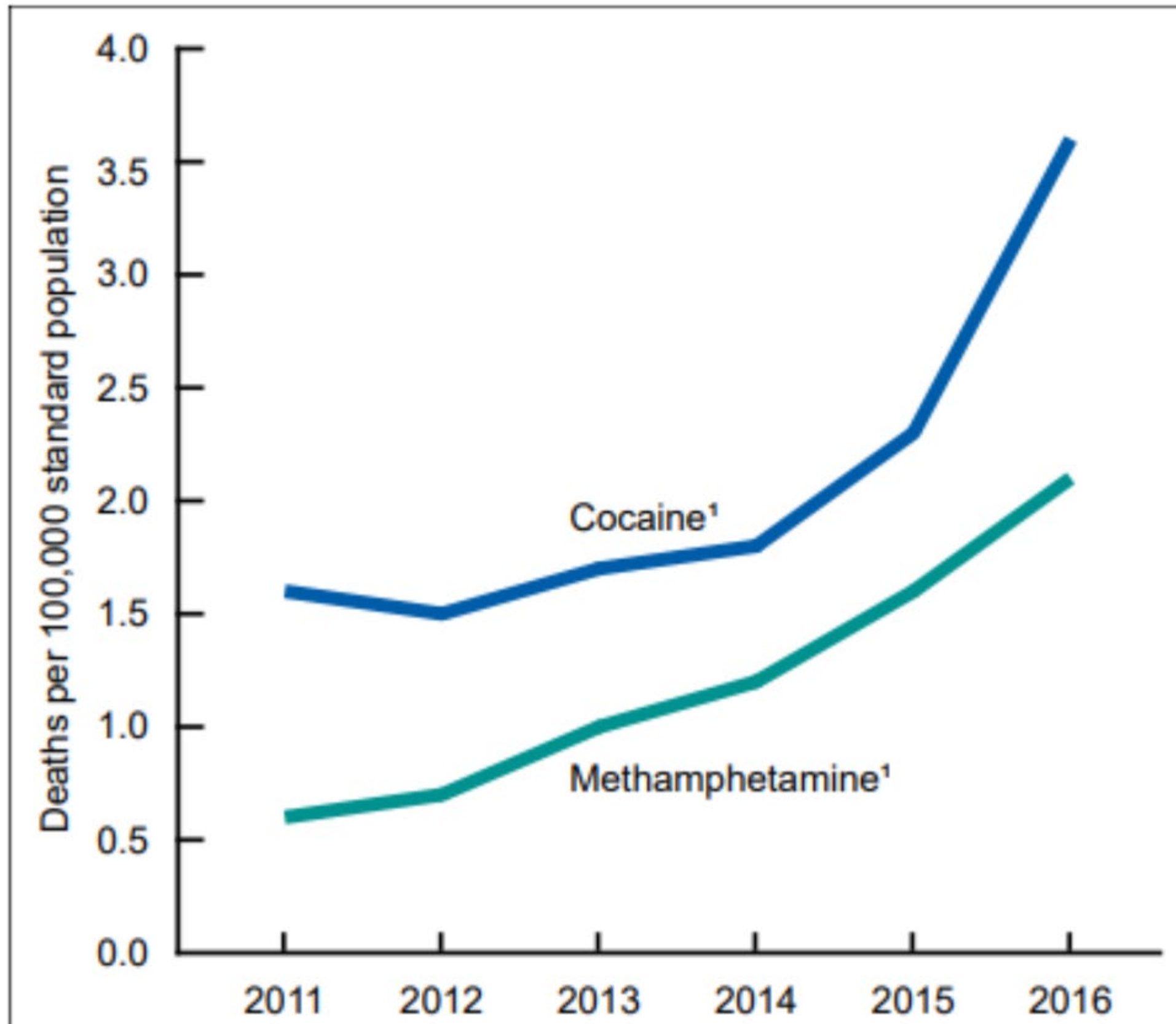


Long Term Effects of Methamphetamine Use

- Extreme weight loss
- Addiction
- Severe dental problems ("meth mouth")
- Intense itching, leading to skin sores from scratching
- Anxiety
- Changes in brain structure and function
- Confusion



Increase in Cocaine & Methamphetamine Overdose Deaths



- Two in five overdose deaths involving cocaine also mentioned fentanyl.
- 34% overdose deaths involving cocaine also mentioned heroin.
- More than 20% of the overdose deaths involving methamphetamine also mentioned heroin.

Cocaine & Methamphetamine Use Increases Risk of Suicide

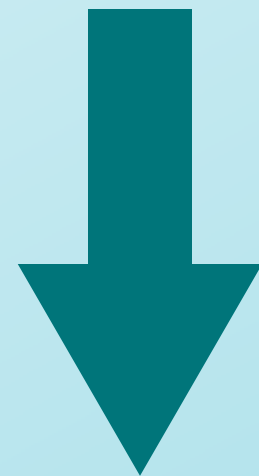
“The researchers found that *chronic and occasional use of stimulant drugs such as cocaine and amphetamines was associated with nearly two -fold greater odds of reporting an attempt* than the use of other drugs to report a suicide attempt. Surprisingly, however, they did not observe the same positive association with other substances, including opiates.”

Why do we see increased suicide with stimulant abuse, but not opiates?

- Neurobiological, behavioral and social differences between stimulant users and opiate users could explain these findings.



Stimulant users are more vulnerable because they are *more impulsive* and characterized by *changing moods* .



Another possible reason is *lack of cocaine addiction treatment programs* (most are focused on alcohol or opiates)

METH LINKED TO IMPAIRED MEMORY AND MOTOR SKILLS

- Methamphetamine linked to continued impairment even after dopamine recovery
- Subjects used 5 days week for 2 years
- Normal loss of dopamine 7% every 10 years
- Subjects had 24% loss or aged 40 years

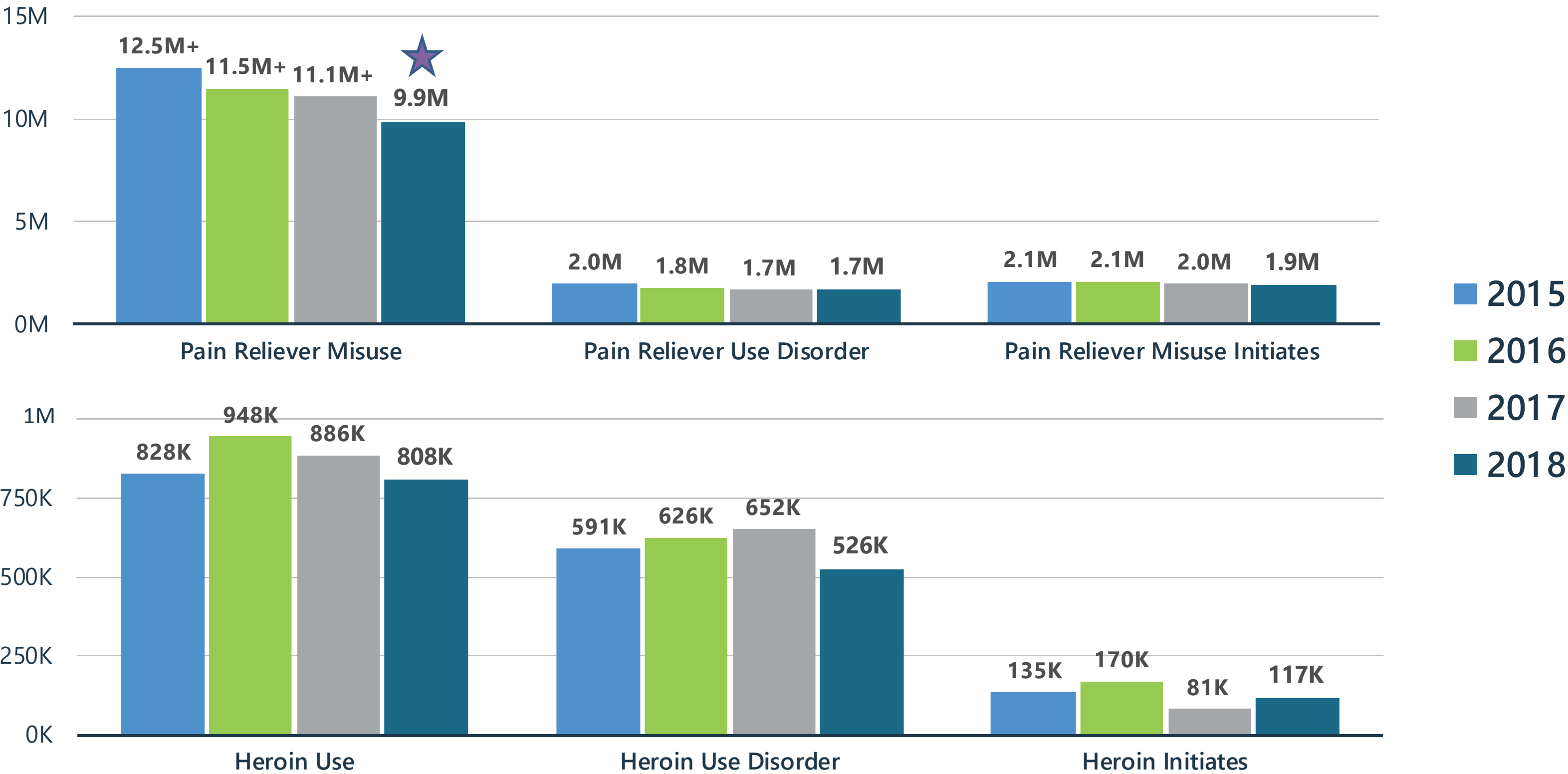




OPIATES

Prescription Pain Reliever Misuse and Heroin Use

PAST YEAR, 2015-2018 NSDUH, 12+



+ Difference between this estimate and the 2018 estimate is statistically significant at the .05 level.

Areas of the Brain Involved

- Limbic system
- Brainstem
- Amygdala
- Thalamus
- Endorphins are increased

Opiates

Signs of Abuse:

- euphoria
- pupil c o n s t r i c t i o n
- c o n s t i p a t i o n
- drows i n e s s
- i t c h i n g
- s l o w e d s p e e c h
- n a u s e a

Signs of Withdrawal:

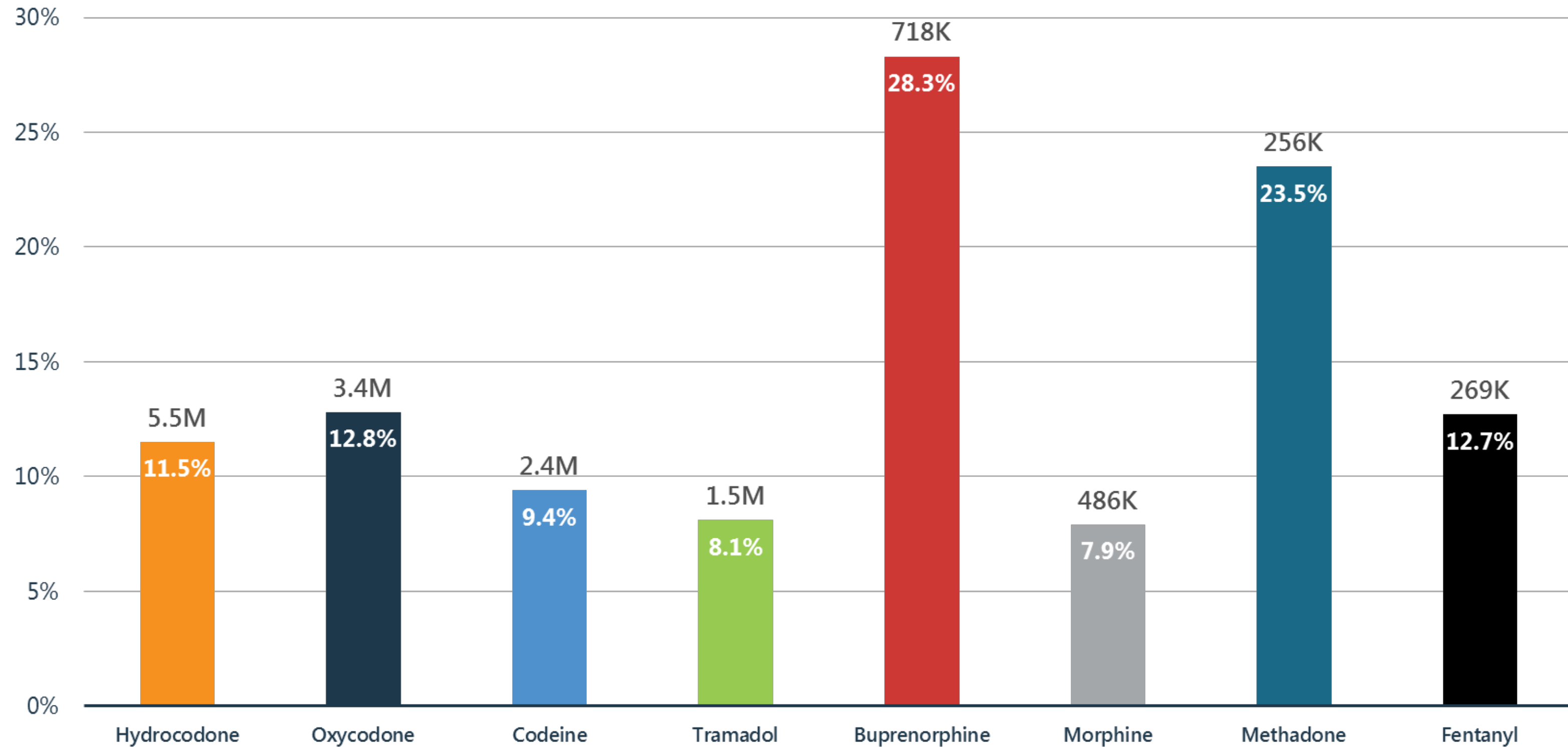
- acute anxiety
- craving
- aches and cramps
- sweats
- insomnia
- vomiting
- increased body functions

Opioid Misuse & Overdose

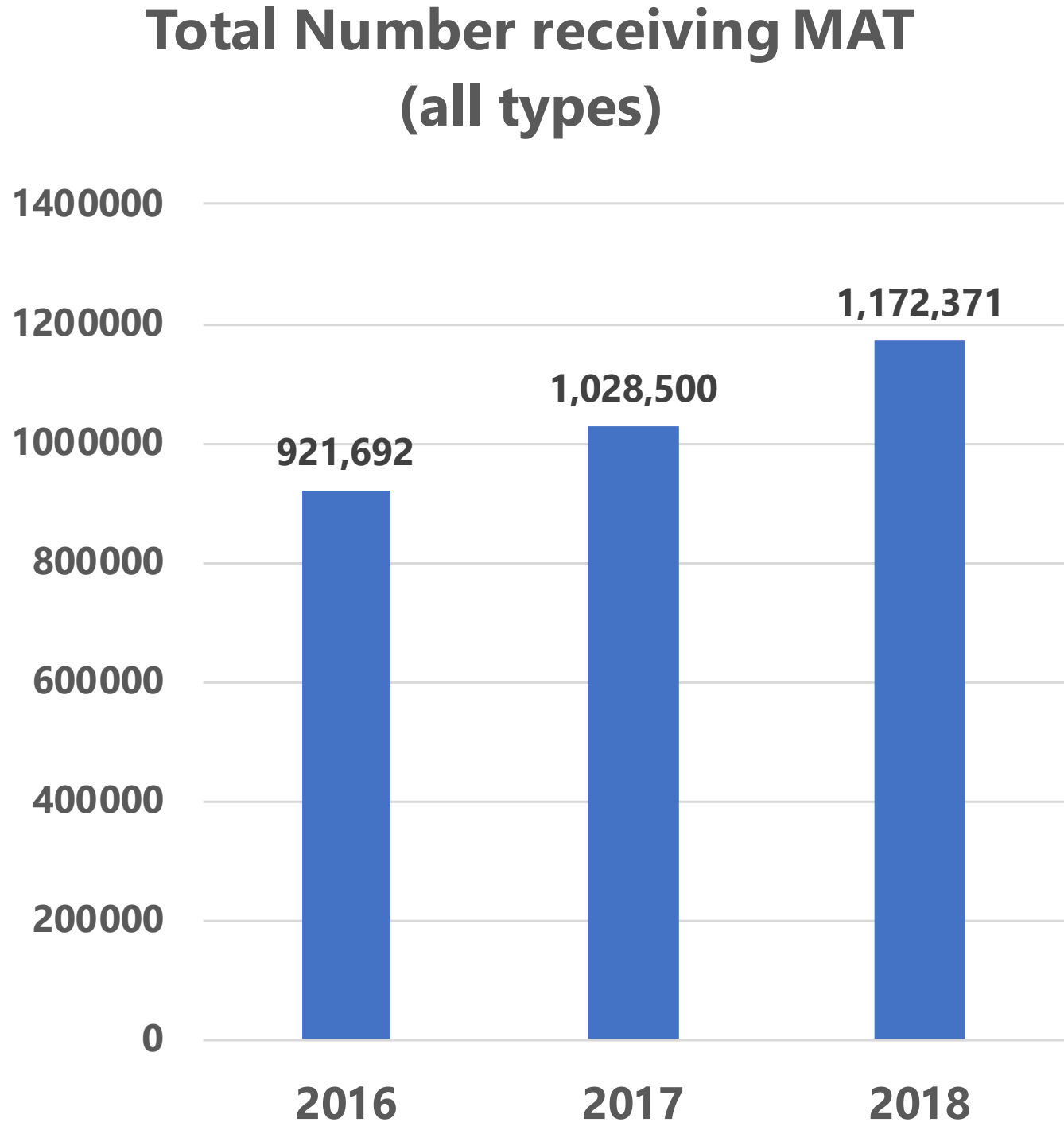
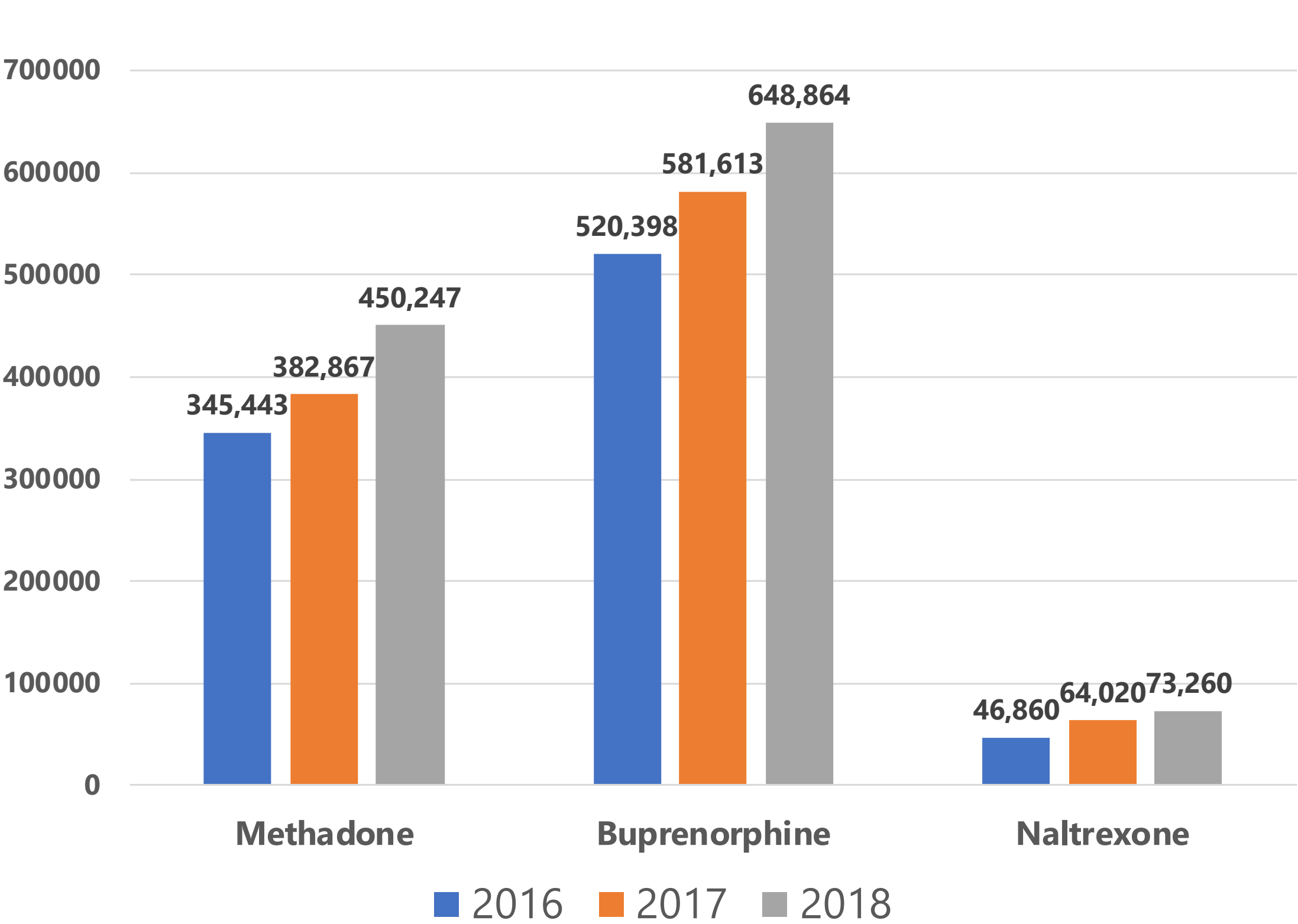
- As of 2017, 11.4 million people misuse opioids: 4.2% of the population.
- "Rates of drug -overdose deaths in this country have outpaced mortality from motor vehicle accidents since 2013."

Mis use of Pres cription Opioid Subtypes

PAST YEAR, 2018 NSDUH, 12+ SUBTYPE USERS



Treatment Gains : Number of Individuals Receiving Pharmacotherapy for Opioid Use Disorder (MAT)



What Does Opioid Addiction Do To The Brain?

When you sense something pleasurable, the brain releases dopamine, which tells the body, "I like this. Let's do it again."

Opioids trigger a release of dopamine greater than anything in nature can produce. "Repeated opioid use overloads circuits in multiple brain regions, including those involved with learning and memory, emotion, judgment and self-control. At the same time, the brain gradually releases less dopamine in response to other things the person once found pleasurable. Eventually they seek more of the drug not to get high, but to avoid constantly feeling low."

Suicide attempts are elevated in adolescents whose parents take prescription opioids for a year or longer.

- Parental opioid use increased the likelihood of a child's suicide attempt by 45%.
- The elevated risk occurred in both children aged 10 to 14 and those aged 15 to 19.

Opiate Short Term Effects

- **After initial rush:** drowsiness, dry mouth, intense itchiness, nausea, slower heart rate & breathing, impaired mental ability
- Accidental overdoses with heroin occur when concentration is unknown and when mixing with other drugs
- Not uncommon for this overdose to lead to death
- IV users often share needles and are at greater risk HIV/AIDS, Hepatitis B and C
- Heroin users often have lung problems, like pneumonia.
- Pregnant women who take heroin during pregnancy have serious childbirth complications: stillbirth, miscarriage, and if the baby survives, typically goes through withdrawal immediately after birth

Source: Alcohol Drug Education Service: Opiate Fact Sheet 2006

Long Term Effects of Opiates

- Needle tracks and collapsed veins
- Frequent infections, acne, and other skin problems due to poor hygiene care and poor health
- Heart and valve infections and liver problems can develop over time as long-term use of opiates weakens the immune system
- Respiratory depression and increased risk of pulmonary and respiratory problems, such as pneumonia and bronchitis

Source: Alcohol Drug Education Service: Opiate Fact Sheet 2006

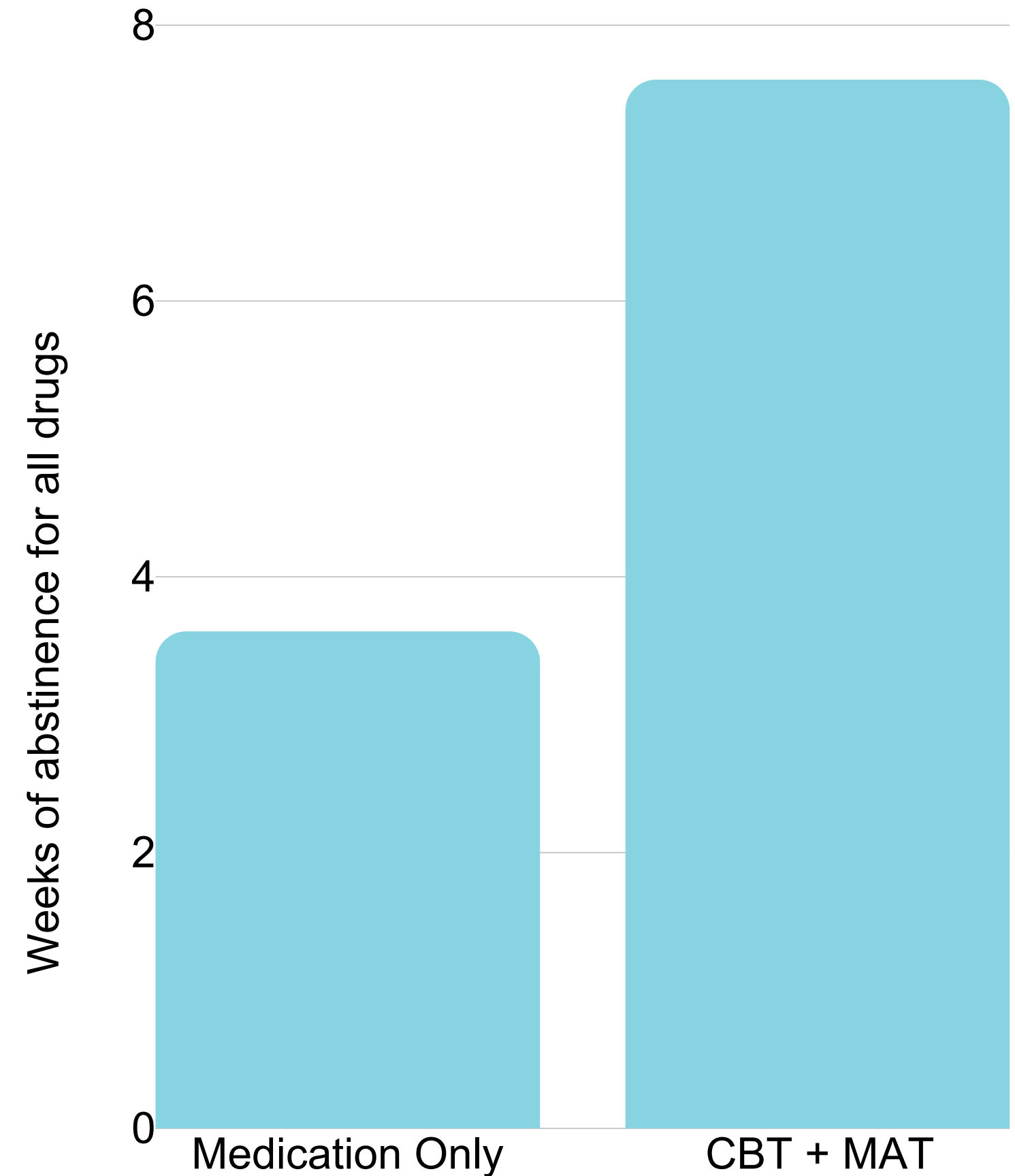
CBT Models Used by Therapeutic Courts

- Moral Reconation Therapy
- Thinking for a Change
- Reasoning & Rehabilitation
- Matrix Model
- Relapse Prevention
- Breaking the Chains of Trauma
- EMDR
- Battling Shadows

EVIDENCE -BASED TREATMENTS: CBT

*CBT improves treatment outcomes
for prescription opioid users:*

Patients assigned to CBT groups
had more than twice the mean
number of weeks of abstinence for
all drugs (7.6) than those assigned
to medication only (3.6)

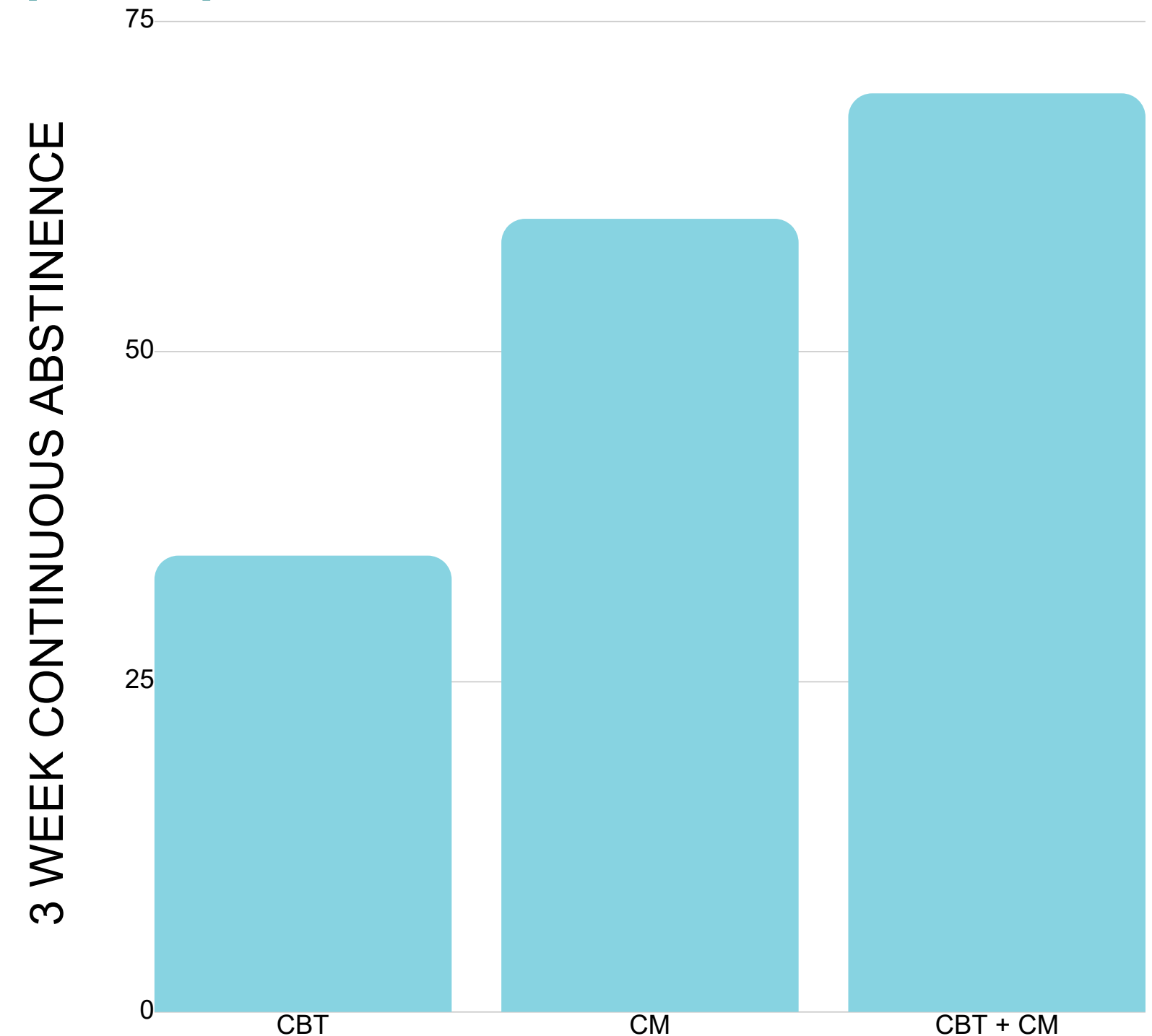


EVIDENCE -BASED TREATMENTS: CBT

- *The combination of CBT + MAT is shown to be significantly more effective than MAT alone at improving emotion -regulation & resilience.*
- *CBT shown to further reduce cravings, depression, & anxiety in opiate users under Methadone Managed Treatment*

Behavioral Interventions: Contingency Management and Cognitive Behavioral Therapy (CBT) for stimulant users

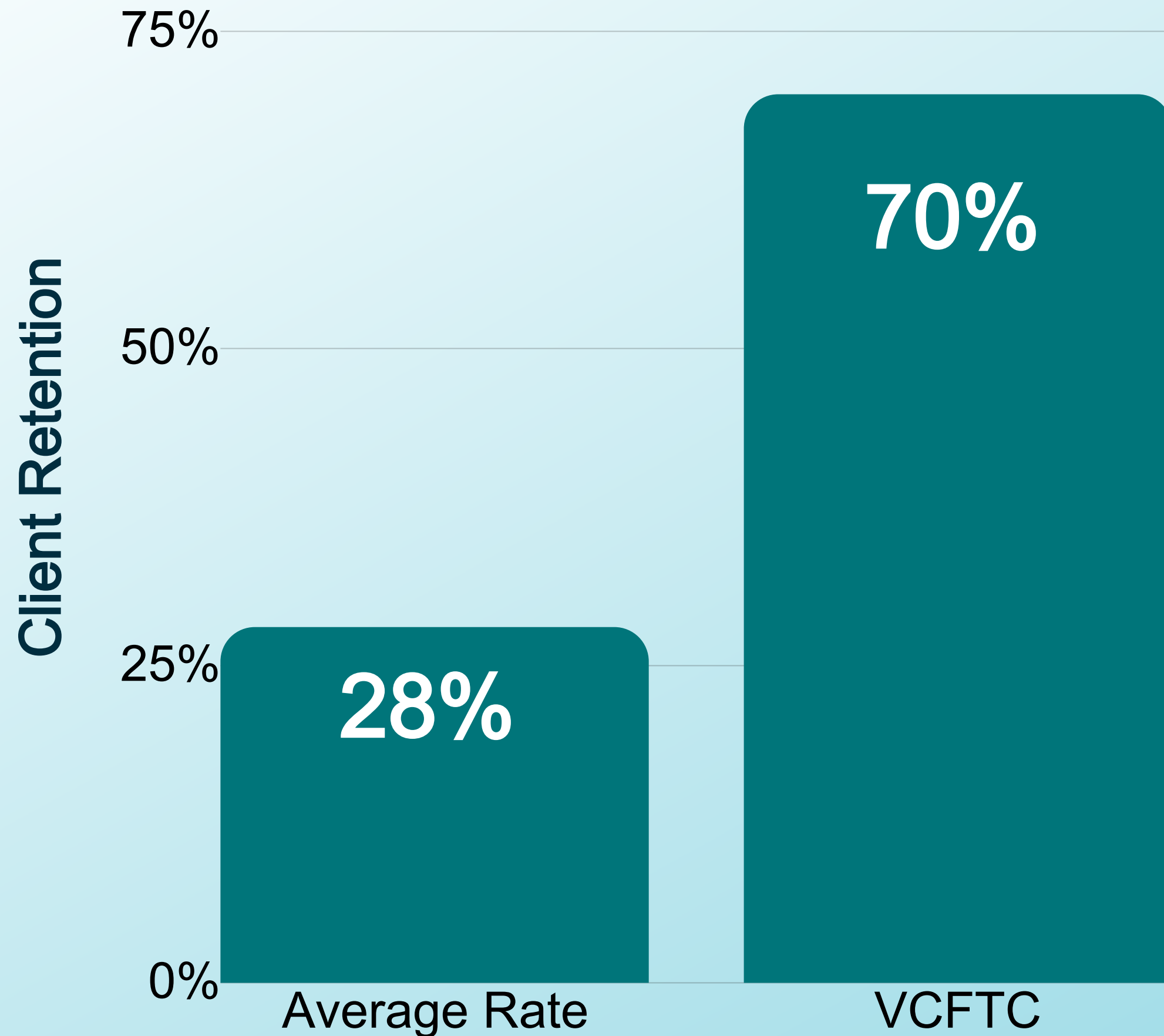
- Three-week continuous abstinence percentages in the 3 groups:
 - CBT: 34.5%
 - CM: 60%
 - CM + CBT: 69.5%
- The CM + CBT and CM groups were statistically significantly different from the CBT group ($P < 0.0001$), but not from each other. There was no additive effect of combining the therapies.



Bonneville County Mental Health Court

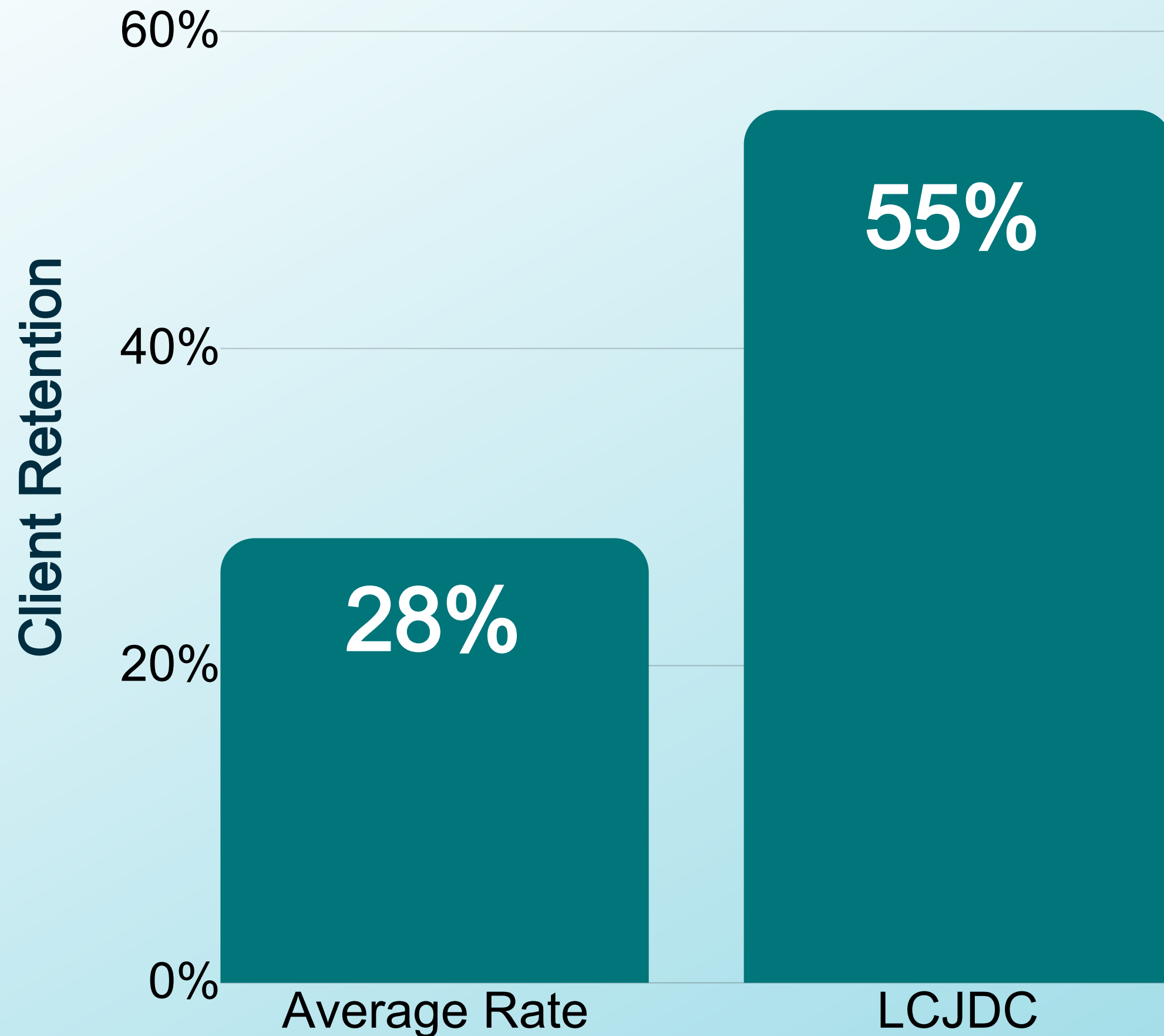
- Began in 2002
- 1 of 5 National Learning Sites
- 1st graduate was a drug court drop out
- 98% decrease in hospitalizations
- 85% decrease in jail days in 3 years
- 6-year outcome shows 75% arrest free

Volusia County Family Treatment Court: Retention Rate



The program is maintaining a 70% retention rate, which far exceeds the average of 28%, reported in research for substance abuse treatment programs.

Lincoln County Juvenile Court: Retention Rate



The positive outcome of producing a 55% Retention Rate continues to be met, which far exceeds the average of 28% reported in research for substance abuse treatment programs.

WestCare KY MATTERS

October 1, 2018 – September 30, 2019

Substance Use Outcome:

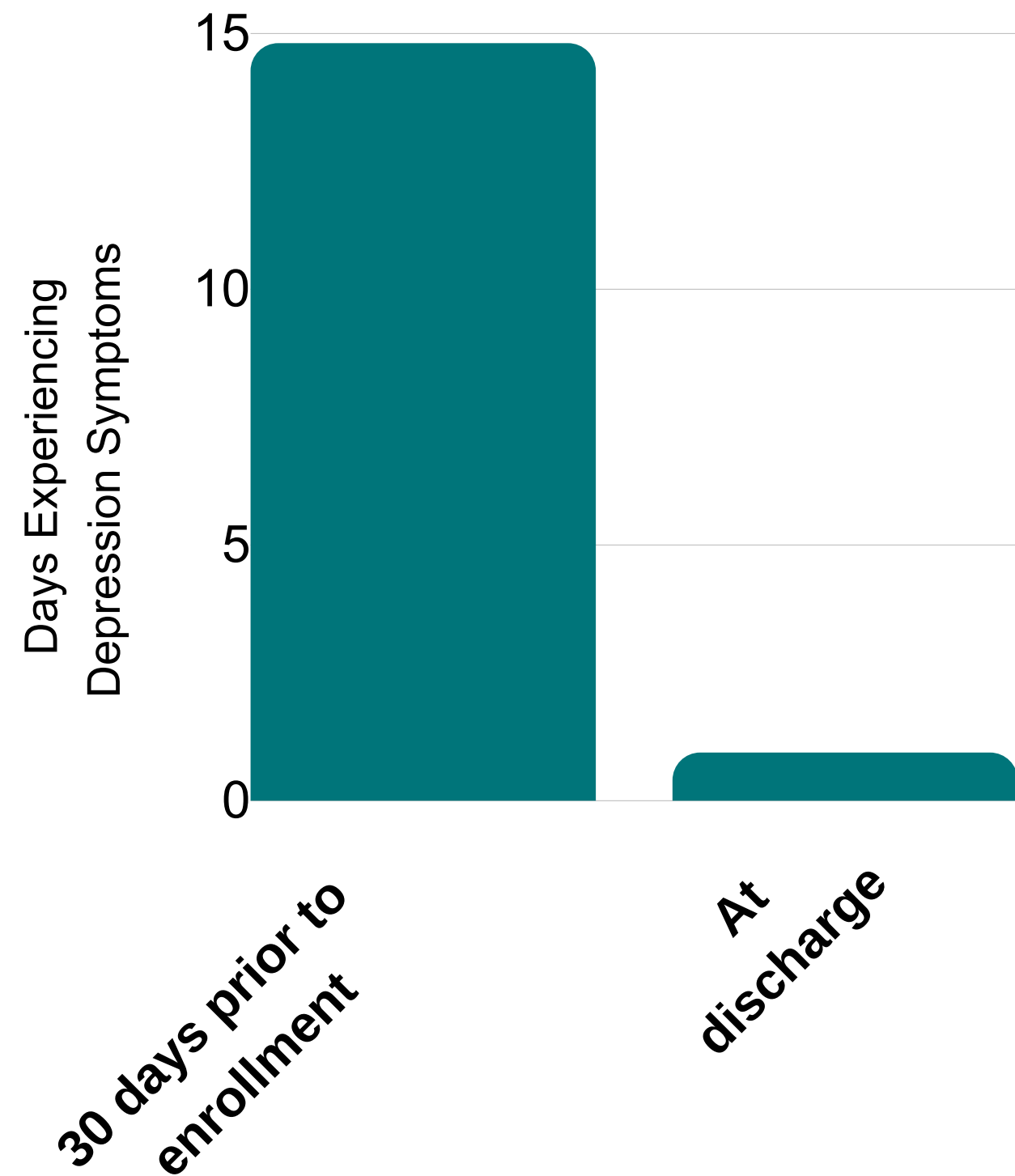
Objective: 80% of clients will be free from illicit drug use and prescription drug misuse at six months post intake.

12 of the 17 clients completing the 6-month post intake follow-up reported using illicit drugs in the 30 days prior to enrollment in the program. Of these 12 clients 11 (91.7%) reported abstaining from illicit drug use in the 30 days prior to the 6-month follow-up. Therefore, the program achieved the goal as stated.

*Based on 6-month follow up data for 17 clients

WestCare KY MATTERS

October 1, 2018 – September 30, 2019

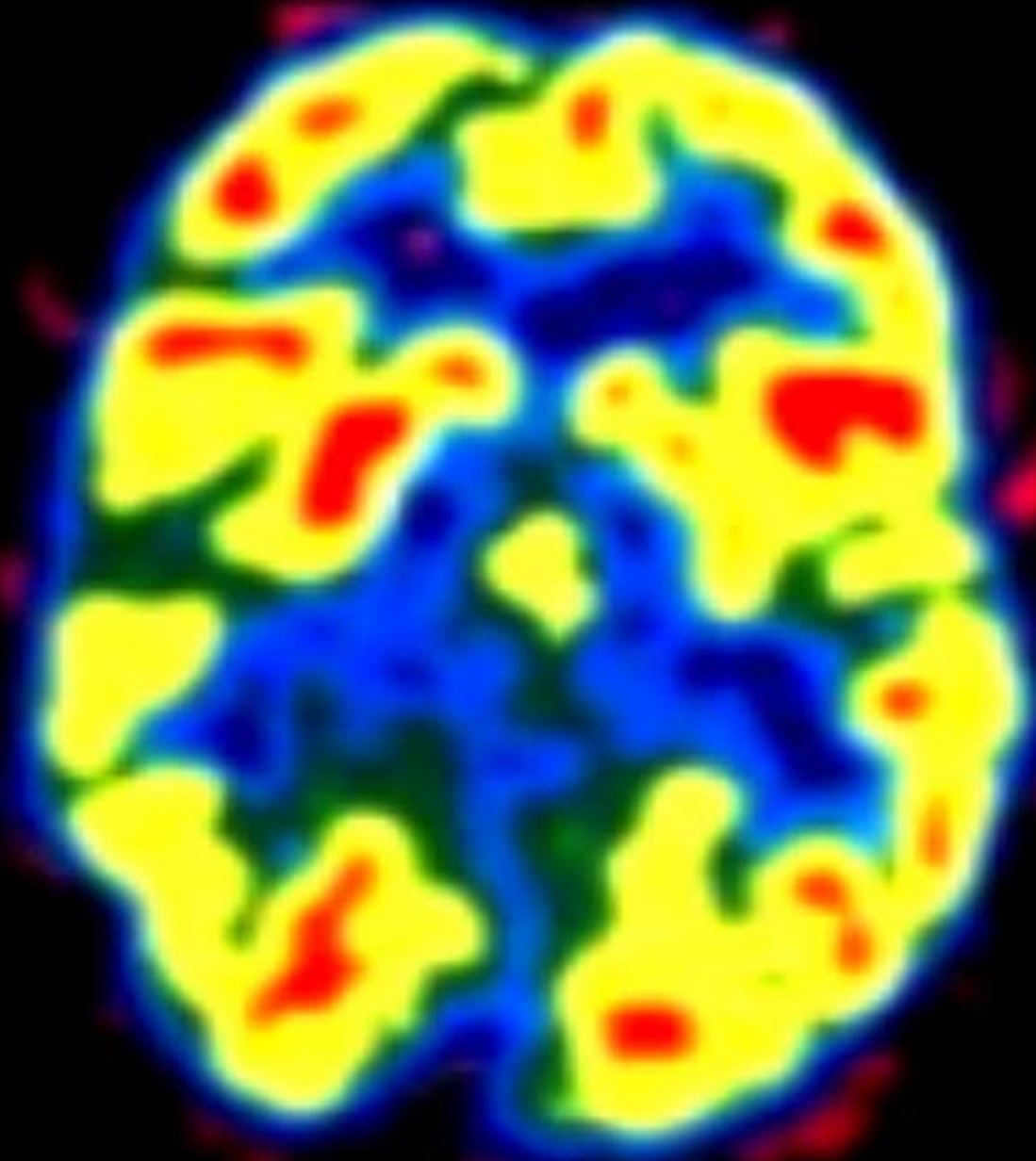


Mental Health Outcome:

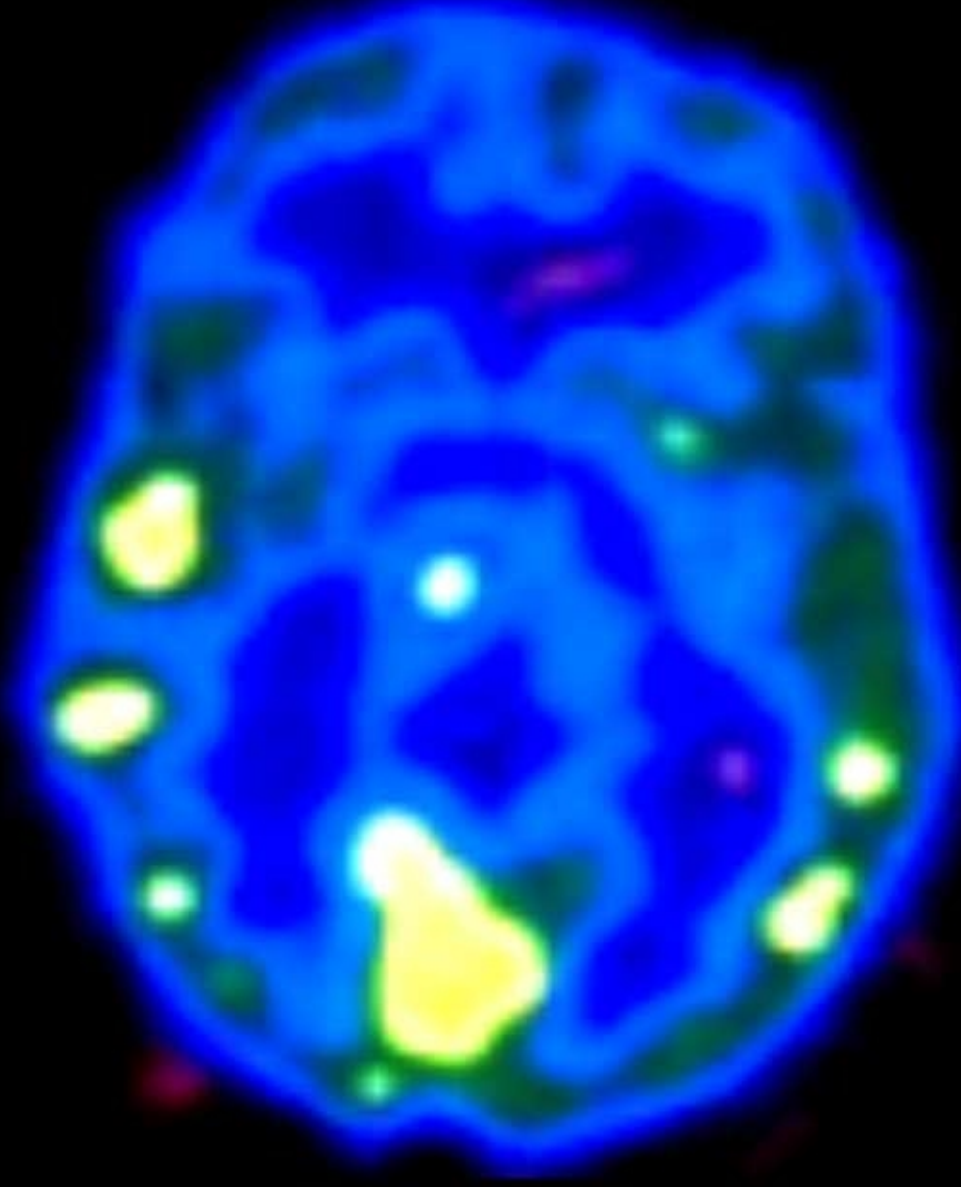
Objective: 70% of clients who successfully complete treatment and saw a decrease in mental health symptoms at 6 months will maintain this decrease at discharge.

A total of 15 clients completing the discharge assessment reported experiencing depression during the 30 days prior to enrollment. These clients reported experiencing symptoms of depression on average of 14.8 days in the prior 30 days. At the discharge assessment these clients reported experiencing depression an average of 0.93 days. This is a reduction of 13.9 days. This change is statistically significant ($p=0.000$) utilizing a paired sample t-test.

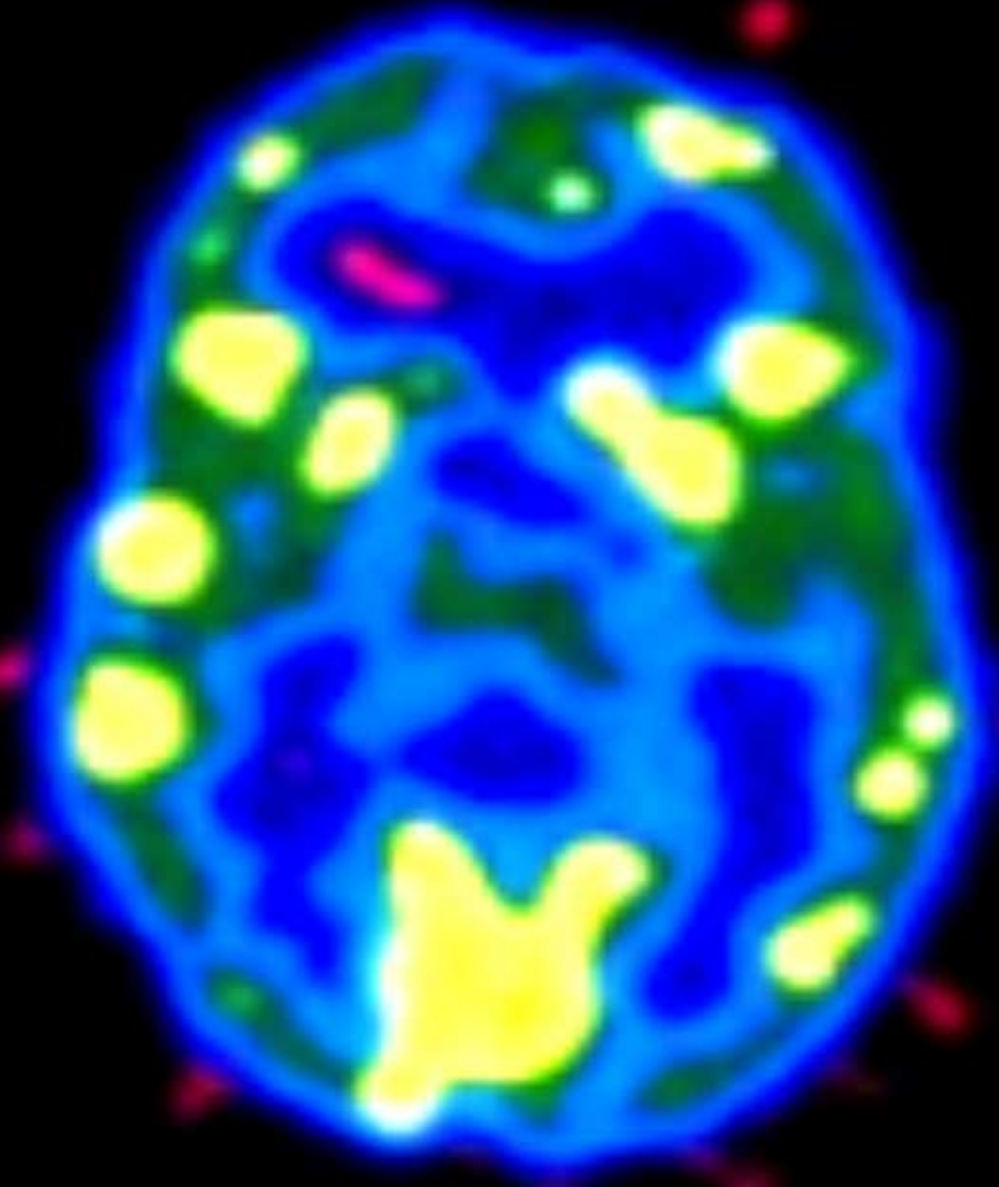
*Based on 6-month follow up data for 17 clients



NORMAL
BRAIN ACTIVITY



COCAINE ABUSER
10 days abstinent



COCAINE ABUSER
100 days abstinent

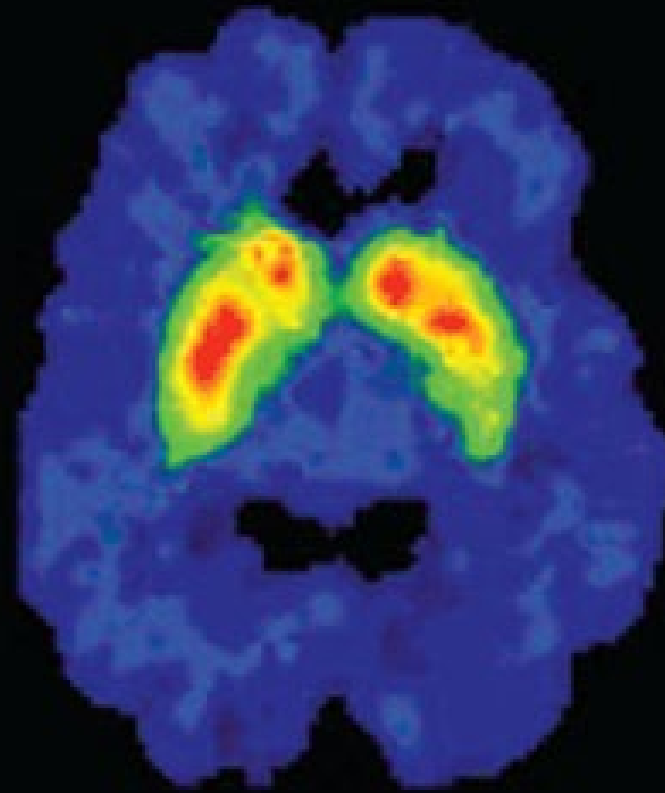


Active Alcohol Use Disorder

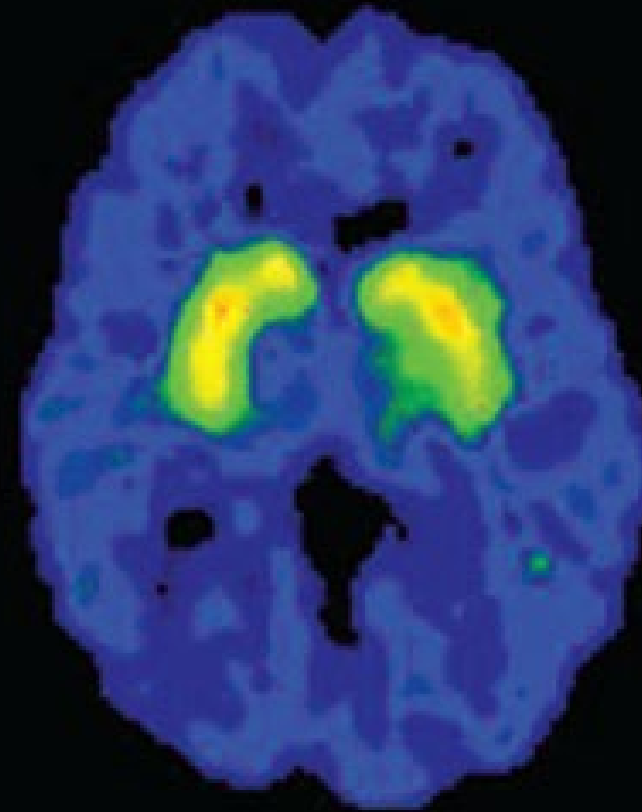


Same Brain, 1 Year Recovery

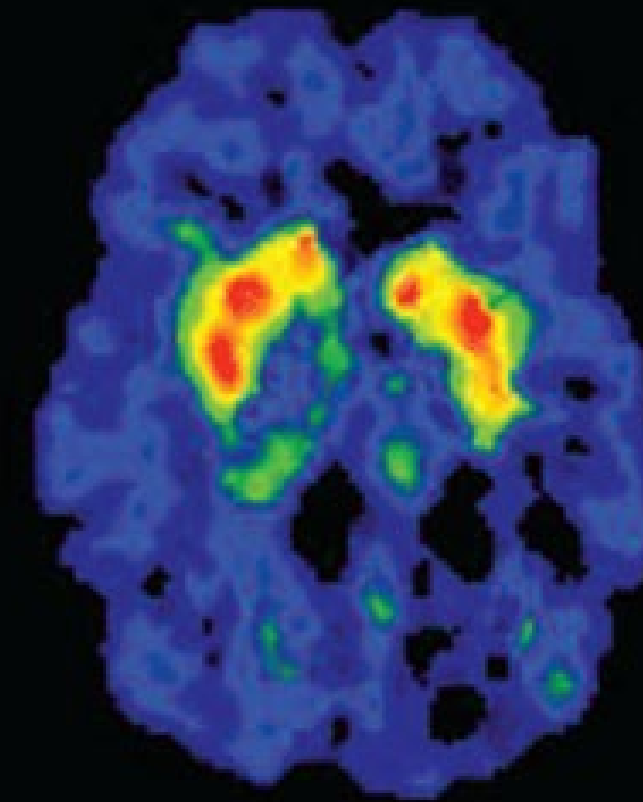
BRAIN RECOVERY WITH PROLONGED ABSTINENCE



HEALTHY
CONTROL



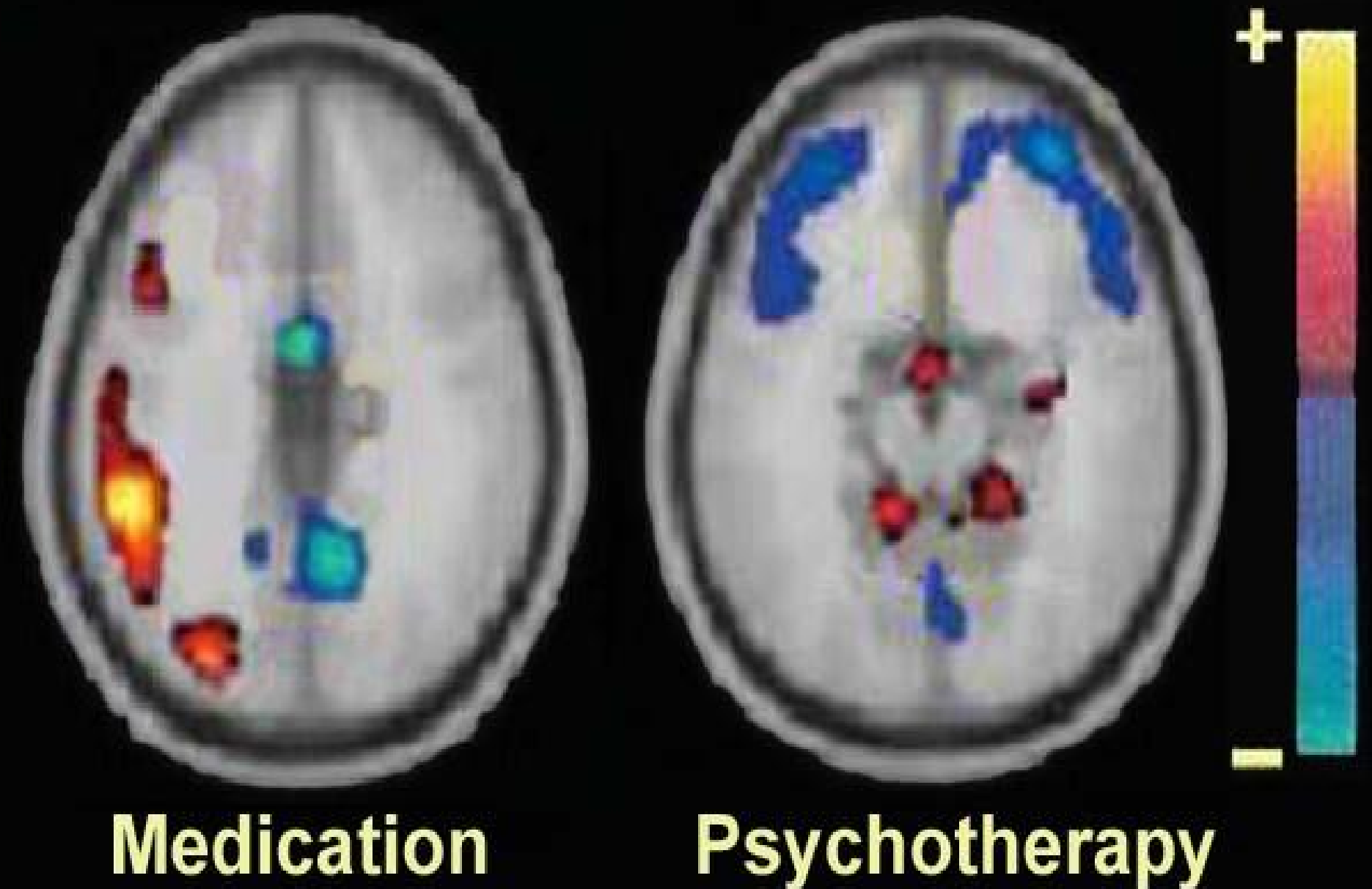
1 MONTH OF
ABSTINENCE



14 MONTHS OF
ABSTINENCE

How Treatment Works

- Medications + psychosocial therapy (and likely CBT) *both* benefit brain function and recovery.
- Each affects different parts of brain and in opposite ways.
- Medication and psychotherapy in study used to treat depression; results also likely true for medication, psychotherapy and CBT used to treat addiction.



PET scans adapted and retouched from Goldapple et al. 2004

Get in touch with us!

Phone: (901) 360-1564

Web: ccimrt.com

Email: ccimrt@ccimrt.com

Questions?



@CCIMRT

@DrRobinsonMRT



@CorrectionalCounselingInc