THE DISEASE OF ADDICTION

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disclosures: none

The following is a true story.

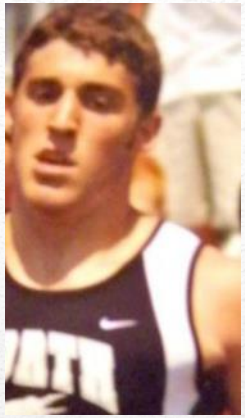
Meet Tyler

Rabinowtiz, Amanda. "Playing through Pain Sometimes Means a Deadly Addiction for Athletes." WKSU. April 24, 2012. Accessed February 18, 2017. http://wksu.org/news/story/31460.

Meet Tyler

- Grows up in an Ohio suburb
  - Median household income $75,000
  - Father works in sales
  - 4-bedroom home
- Kind, devoted
- Enjoys fishing, spending time with pets
- Attends Sycamore Creek church

- Father calls him the "'consummate scholar-athlete'"
  - Varsity football
  - Varsity baseball
  - Track
- Turns down an offer to play for a different high school football team as a senior even though it may position him better for college
  - "'These are my friends, Dad. They look to me for leadership. I could never leave them.'"



Corvo, Kevin. "Heroin Leaves Broken Families in Its Wake." ThisWeek Community News. October 8, 2014. Accessed February 08, 2016. http://www.thisweeknews.com/content/stories/2014/10/02/HEROIN-STORIES/heroin-leaves-broken-families-in-its-wake.html.
Denholm, Kristine Meldrum. "When Painkilling Becomes an Addiction for Young Athletes." USA Today High School Sports. September 02, 2015. Accessed February 18, 2017. http://usatodayhss.com/2015/when-painkilling-becomes-an-addiction-for-young-athletes.
"Tyler Wayne Campbell Obituary." The Columbus Dispatch. July 24, 2011. Accessed February 18, 2017. http://www.legacy.com/obituaries/dispatch/obituary.aspx?pid=152691404.
Rabinowtiz, Amanda. "Playing through Pain Sometimes Means a Deadly Addiction for Athletes." WKSU. April 24, 2012. Accessed February 18, 2017. http://wksu.org/news/story/31460.
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ADDICTION HAS GENETIC RISK FACTORS

ADDICTION HAS GENETIC RISK FACTORS

- Genetics account for 40-70% of the risk
- Alcohol: CRHBP, DRD2, NPY2R, SNCA, GABRA2, CRHR1, CRHBP, OPRK1, PDYN, CHRNA5, NFKB1, GRM8, HTR7, KCNJ6, C15orf53, OR51L1, KCNJ6

Koob, George. "Neurobiology of Addiction." Lecture, Essentials of Addiction Medicine: A Conference on the Treatment of Substance Use Disorders, Anaheim, CA, August 26, 2016. Lecture accessed online January 14, 2017.
U.S. Department of Health and Human Services (HHS), Office of the Surgeon General, *Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health*. Washington, DC: HHS, November 2016, 2-22.

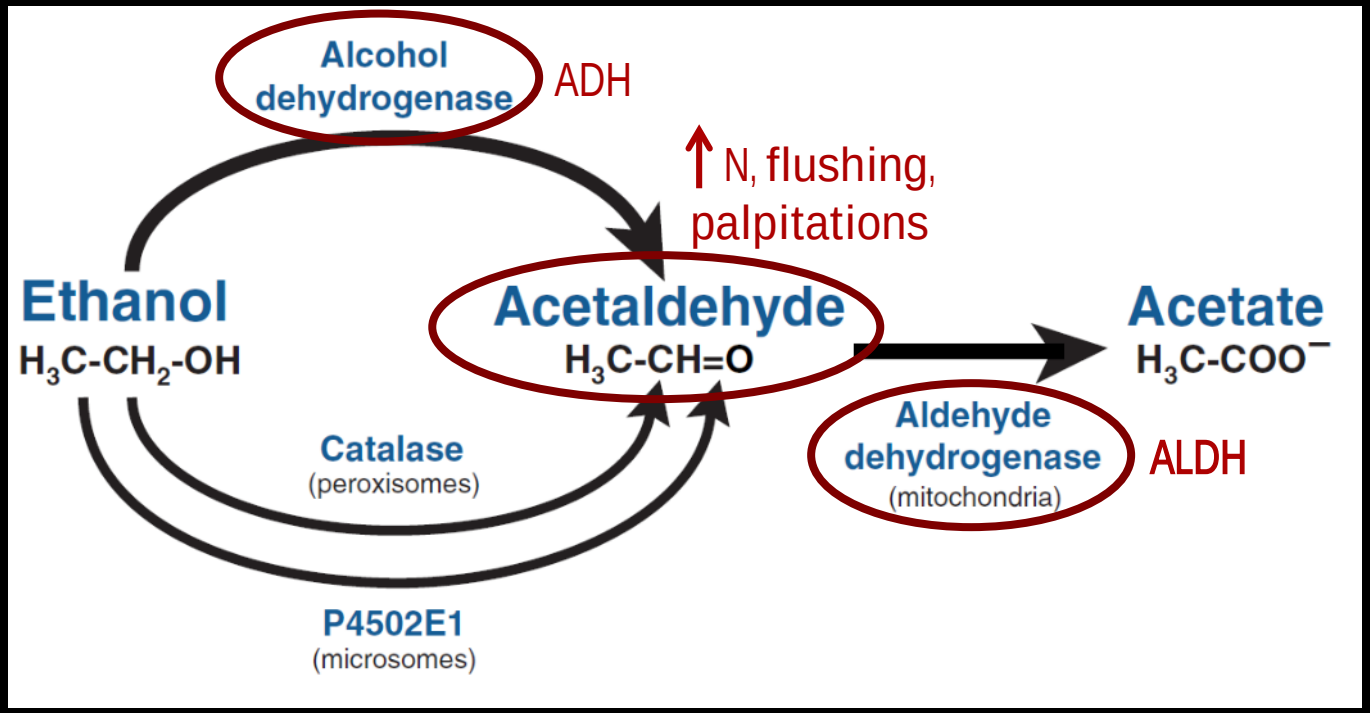
ADDICTION HAS GENETIC RISK FACTORS

Fast ADH or slow ALDH → ↑ acetaldehyde

Fast ADH genes:

ADH1B*2 common in Chinese, Japanese, Korean descent

ADH1B*3 present in 15-25% of African Americans



U.S. Department of Health & Human Services. "Alcohol Metabolism: An Update." National Institute on Alcohol Abuse and Alcoholism: Alcohol Alert, Number 72. July 2007. Accessed January 31, 2017. https://pubs.niaaa.nih.gov/publications/aa72/aa72.htm.

ADDICTION HAS ENVIRONMENTAL RISK FACTORS

ADDICTION HAS ENVIRONMENTAL RISK FACTORS

- Parental drug use/addiction
- Parental depression
- Poor parenting
- Low socioeconomic status
- Stress
- Poor social support
- Drug availability
- School
- Neighborhood
- Advertising

Koob GF, Volkow ND. Neurobiology of addiction: a neurocircuitry analysis. Lancet Psychiatry. 2016 Aug;3(8):768.

ADDICTION HAS ENVIRONMENTAL RISK FACTORS

The Adverse Childhood Experiences (ACE) Study

- Methods: patients at Kaiser Permanente's San Diego Health Appraisal Clinic who had a health appraisal (H&P with questionnaires and labs) between 8/95 and 3/96 were sent a follow-up survey covering seven categories of childhood "abuse and household dysfunction"
- N = 8,056
- Population: mean age 56.1 years, 52.1% female, 79.4% white, 43% college diploma
- Childhood abuse and household dysfunction was compared to adult morbidity and mortality

Risk Factors Contributing to Leading Causes of Morbidity and Mortality

- Smoking
- Severe obesity
- Physical inactivity
- Depressed mood
- Suicide attempts
- Alcoholism
- Any drug abuse
- Parenteral drug abuse
- High lifetime number of sexual partners (≥50)
- History of STI

Leading Causes of Mortality

- History of ischemic heart disease
- Cancer
- Stroke
- Chronic bronchitis or emphysema (COPD)
- Diabetes
- Hepatitis or jaundice
- Any skeletal fractures ("as a proxy for risk for unintentional injury")

Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, Koss MP, Marks JS. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. Am J Prev Med. 1998 May;14(4):245-258.

ADDICTION HAS ENVIRONMENTAL RISK FACTORS

7 categories of childhood abuse and household dysfunction

Table 1. Prevalence of childhood exposure to abuse and household dysfunction

Category of childhood exposure[a]	Prevalence (%)	Prevalence (%)
Abuse by category		
Psychological		**11.1**
(Did a parent or other adult in the household . . .)		
Often or very often swear at, insult, or put you down?	10.0	
Often or very often act in a way that made you afraid that you would be physically hurt?	4.8	
Physical		**10.8**
(Did a parent or other adult in the household . . .)		
Often or very often push, grab, shove, or slap you?	4.9	
Often or very often hit you so hard that you had marks or were injured?	9.6	
Sexual		**22.0**
(Did an adult or person at least 5 years older ever . . .)		
Touch or fondle you in a sexual way?	19.3	
Have you touch their body in a sexual way?	8.7	
Attempt oral, anal, or vaginal intercourse with you?	8.9	
Actually have oral, anal, or vaginal intercourse with you?	6.9	
Household dysfunction by category		
Substance abuse		**25.6**
Live with anyone who was a problem drinker or alcoholic?	23.5	
Live with anyone who used street drugs?	4.9	
Mental illness		**18.8**
Was a household member depressed or mentally ill?	17.5	
Did a household member attempt suicide?	4.0	
Mother treated violently		**12.5**
Was your mother (or stepmother)		
Sometimes, often, or very often pushed, grabbed, slapped, or had something thrown at her?	11.9	
Sometimes, often, or very often kicked, bitten, hit with a fist, or hit with something hard?	6.3	
Ever repeatedly hit over at least a few minutes?	6.6	
Ever threatened with, or hurt by, a knife or gun?	3.0	
Criminal behavior in household		
Did a household member go to prison?	3.4	**3.4**
	Any category reported	**52.1%**

[a]An exposure to one or more items listed under the set of questions for each category.

Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, Koss MP, Marks JS. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. Am J Prev Med. 1998 May;14(4):248.

ADDICTION HAS ENVIRONMENTAL RISK FACTORS

Health problem	Number of categories	Sample size (N)[a]	Prevalence (%)[b]	Adjusted odds ratio[c]	95% confidence interval
Current smoker[d]	0	3,836	6.8	1.0	Referent
	1	2,005	7.9	1.1	(0.9–1.4)
	2	1,046	10.3	1.5	(1.1–1.8)
	3	587	13.9	2.0	(1.5–2.6)
	4 or more	544	16.5	2.2	(1.7–2.9)
	Total	8,018	8.6	—	—
Considers self an alcoholic	0	3,841	2.9	1.0	Referent
	1	1,993	5.7	2.0	(1.6–2.7)
	2	1,042	10.3	4.0	(3.0–5.3)
	3	586	11.3	4.9	(3.5–6.8)
	4 or more	540	16.1	7.4	(5.4–10.2)
	Total	8,002	5.9	—	—
Ever used illicit drugs	0	3,856	6.4	1.0	Referent
	1	1,998	11.4	1.7	(1.4–2.0)
	2	1,045	19.2	2.9	(2.4–3.6)
	3	589	21.5	3.6	(2.8–4.6)
	4 or more	541	28.4	4.7	(3.7–6.0)
	Total	8,029	11.6	—	—
Ever injected drugs	0	3,855	0.3	1.0	Referent
	1	1,996	0.5	1.3	(0.6–3.1)
	2	1,044	1.4	3.8	(1.8–8.2)
	3	587	2.3	7.1	(3.3–15.5)
	4 or more	540	3.4	10.3	(4.9–21.4)
	Total	8,022	0.8	—	—

Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, Koss MP, Marks JS. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. Am J Prev Med. 1998 May;14(4):252-253.

Tyler makes the Zips

- Sends 30-40 letters to schools about walk-on positions
- Accepted to University of Akron as a walk-on
- 2007, plays 12 games as a freshman walk-on
  - "'He hit like a freight train'"
- 2008, awarded a scholarship
- Zips have a weak defense (including defensive line, cornerbacks, linebackers – this means safeties are often making the tackles)
- Tyler gets 18 tackles in the opening game against Wisconsin
- For one week, Tyler leads the nation in tackles

Denholm, Kristine Meldrum. "When Painkilling Becomes an Addiction for Young Athletes." USA Today High School Sports. September 02, 2015. Accessed February 18, 2017. http://usatodayhss.com/2015/when-painkilling-becomes-an-addiction-for-young-athletes.

Quinones, Sam. *Dreamland: The True Tale of America's Opiate Epidemic*. New York: Bloomsbury Press, 2015. 297.

Rabinowtiz, Amanda. "Playing through Pain Sometimes Means a Deadly Addiction for Athletes." WKSU. April 24, 2012. Accessed February 18, 2017. http://wksu.org/news/story/31460.

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Tyler's 60 Tabs

- Mumford Procedure at St. Thomas Hospital in January
  - Indication pain secondary to distal clavicular osteolysis?
- Discharged home with 60 Percocet or Vicodin

Case courtesy of Dr Maulik S Patel, Radiopaedia.org, rID: 12812. Accessed February 18, 2017. https://radiopaedia.org/encyclopaedia/quizzes/all/12812/studies/12937.

Corvo, Kevin. "Heroin Leaves Broken Families in Its Wake." ThisWeek Community News. October 8, 2014. Accessed February 08, 2016. http://www.thisweeknews.com/content/stories/2014/10/02/HEROIN-STORIES/heroin-leaves-broken-families-in-its-wake.html.

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ADDICTION IS A DISEASE OF ADOLESCENCE

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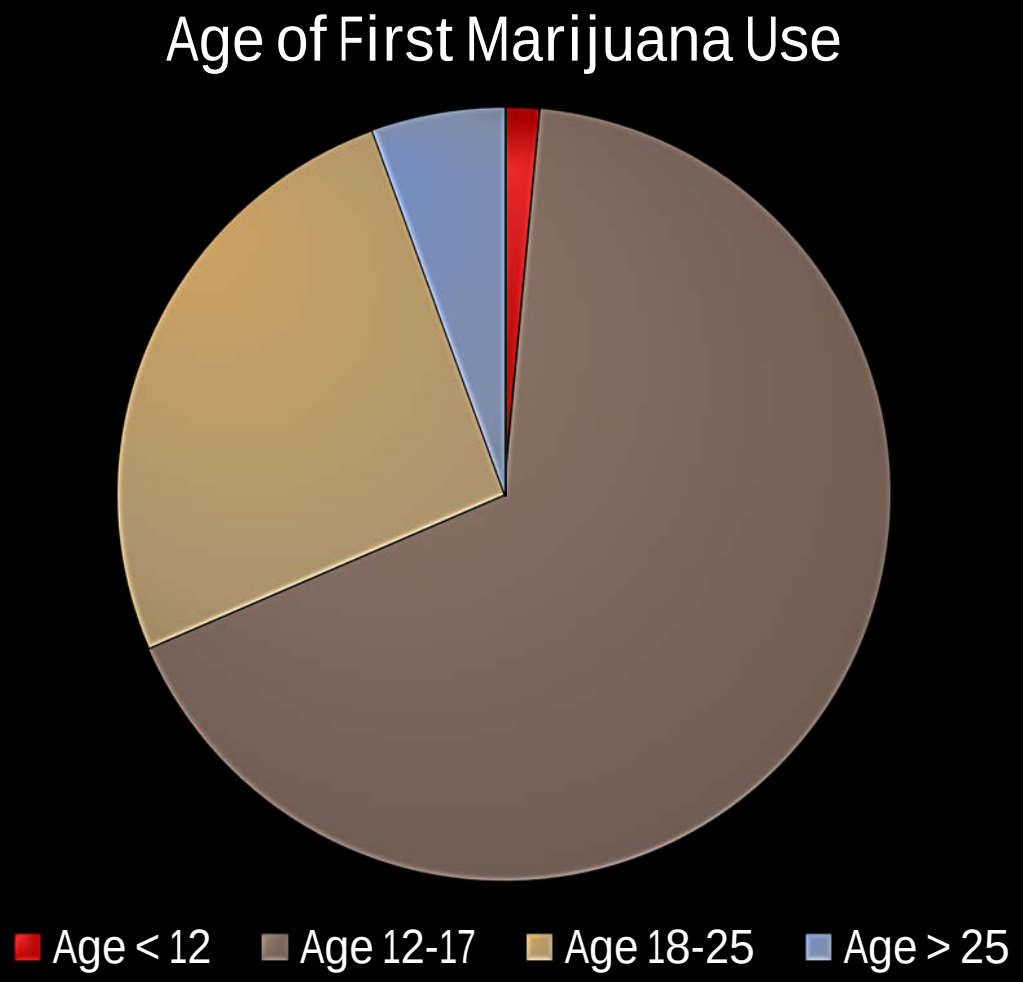

National Institute on Drug Abuse. "Drug Abuse & Addiction." Lecture, Viewed February 5, 2017. https://www.drugabuse.gov/sites/default/files/addictionscience.ppt

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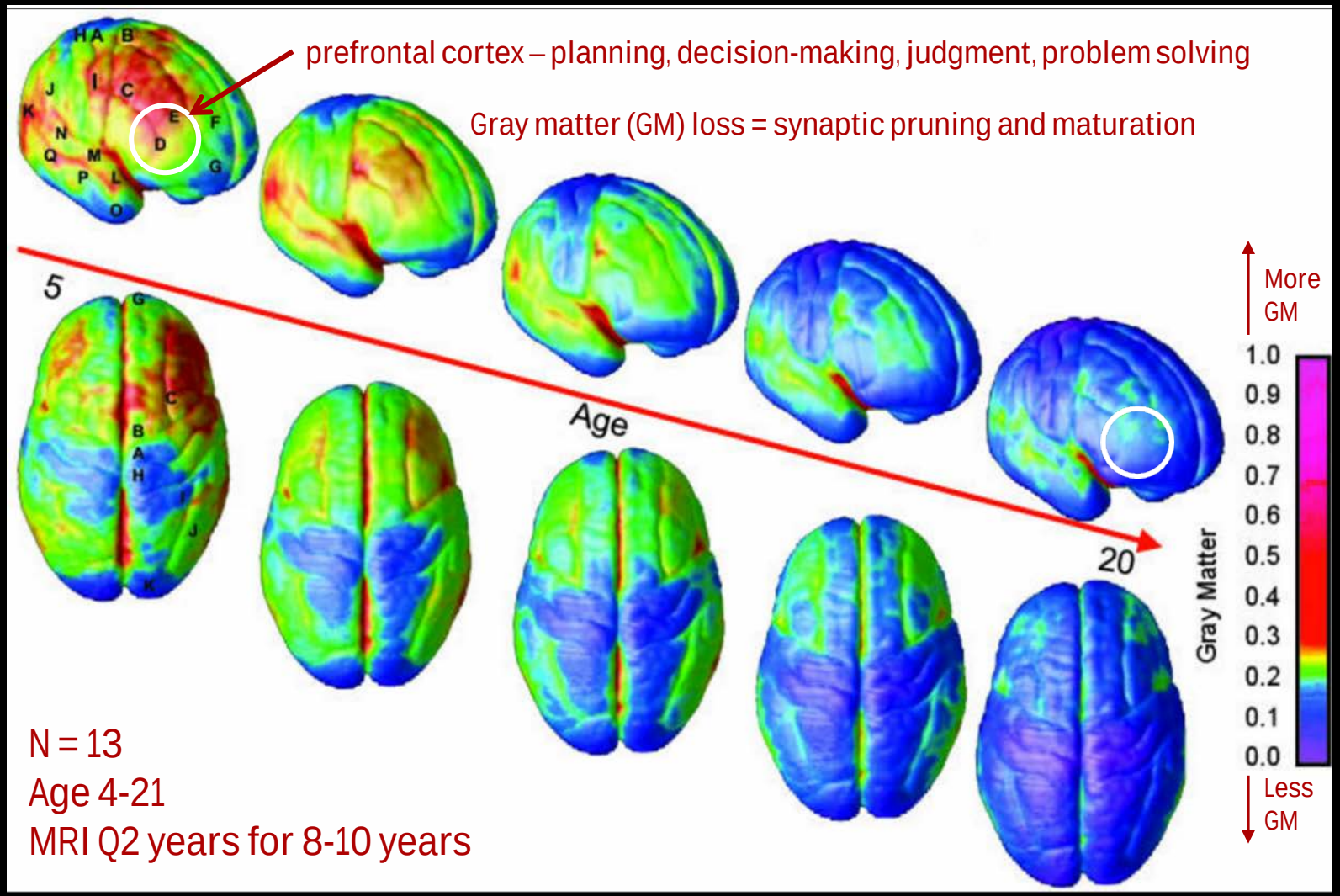

Image: Gogtay N, Giedd JN, Lusk L, Hayashi KM, Greenstein D, Vaituzis AC, Nugent TF 3rd, Herman DH, Clasen LS, Toga AW, Rapoport JL, Thompson PM. Dynamic mapping of human cortical development during childhood through early adulthood. Proc Natl Acad Sci U S A. 2004 May 25;101(21):8174-9.
National Institute on Drug Abuse. "Drug Abuse & Addiction." Lecture, Viewed February 5, 2017.
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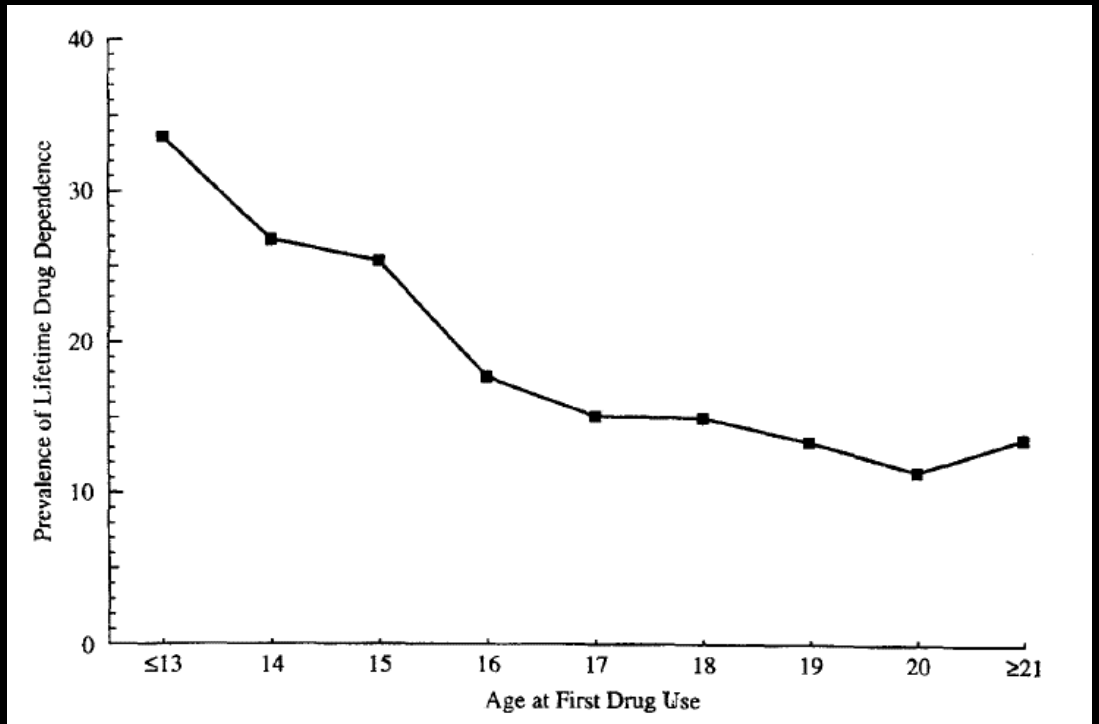

FIGURE 2
Prevalence of Lifetime Drug Dependence by Age at First Drug Use

- Methods: face-to-face interviews conducted using the Alcohol use Disorder and Associated Disabilities Interview Schedule. DSM-IV lifetime diagnoses of drug abuse and dependence were assessed.
- Population: 42,862 noninstitutionalized adults (>18) in the National Longitudinal Alcohol Epidemiologic Survey (NLAES).
- Response rate: 92% of households, 97%of respondents in households.
- *"The odds of lifetime drug dependence were reduced by 4% with each additional year that drug use onset was delayed."*

Grant BF, Dawson DA. Age of onset of drug use and its association with DSM-IV drug abuse and dependence: results from the National Longitudinal Alcohol Epidemiologic Survey. J Subst Abuse. 1998;10(2):163-73.

ADDICTION IS A DISEASE OF ADOLESCENCE

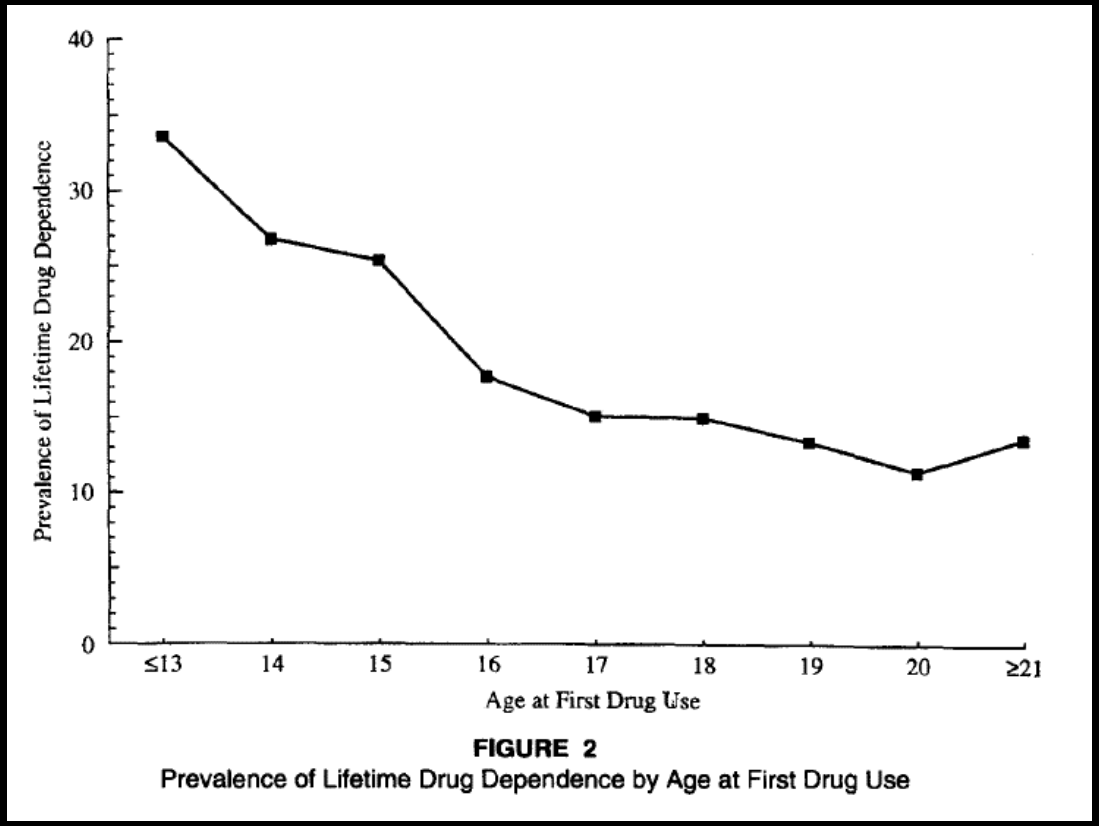

FIGURE 2
Prevalence of Lifetime Drug Dependence by Age at First Drug Use

Age of First Drug Use	Percent with Lifetime Drug Use
13 and younger	33.6%
14	26.8%
15	25.4%
16	17.7%
17	15.1%
18	15.0%
19	13.4%
20	11.4%
21 and older	13.6%

Grant BF, Dawson DA. Age of onset of drug use and its association with DSM-IV drug abuse and dependence: results from the National Longitudinal Alcohol Epidemiologic Survey. J Subst Abuse. 1998;10(2):168-169.

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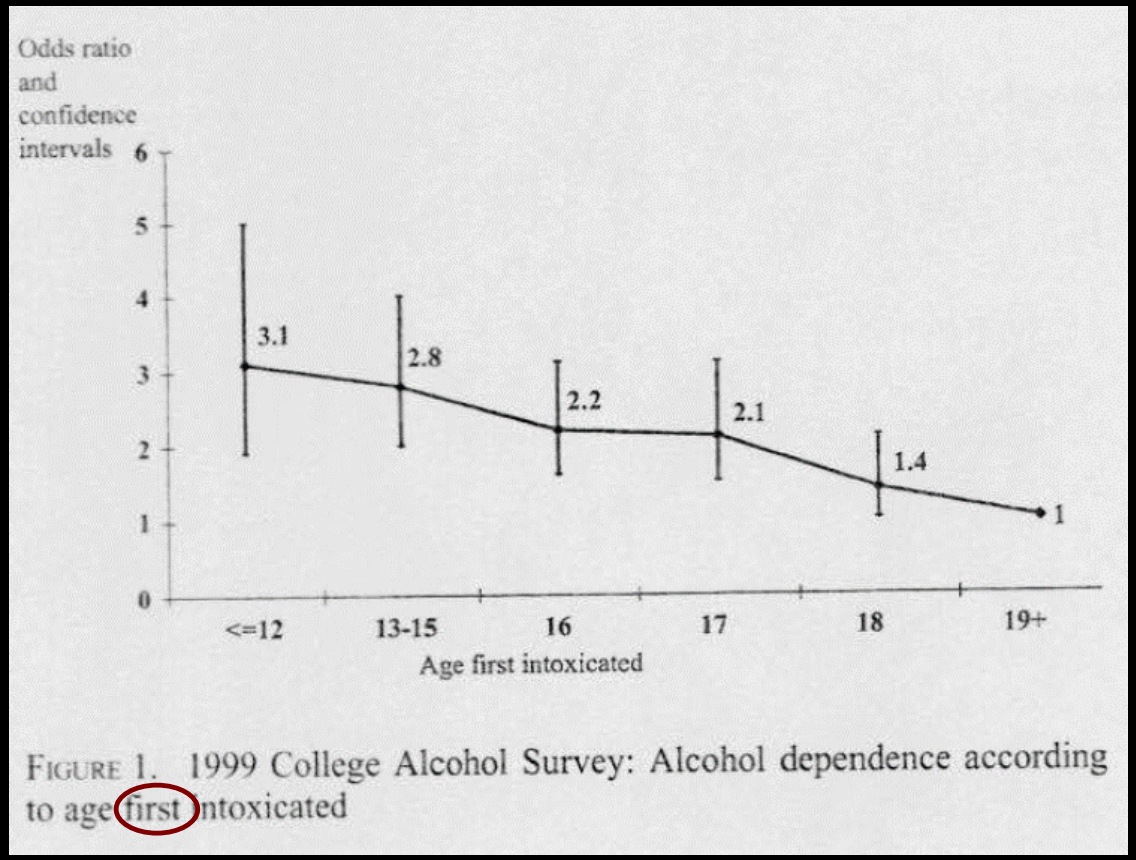

FIGURE 1. 1999 College Alcohol Survey: Alcohol dependence according to age first intoxicated

- Methods: 119 college sample from the American Council on Education's list of 4-year accredited colleges. 225 full-time students from each college were randomly sent the Harvard College Alcohol Survey
  - Age of first intoxication
  - Heavy periodic drinking
  - DSM-IV criteria
  - Injuries with/without alcohol use
  - Drinking and driving behaviors
- Population: colleges 2/3 public, 44% ≥ 10,000 students, 2/3 suburban/urban.
- Response rate: 60% of 14,138 possible students respond
- *"Among college students who drink, those who reported being younger when they first became drunk were more likely to meet diagnostic criteria for alcohol dependence and to report heavy episodic drinking."*

Hingson R, Heeren T, Zakocs R, Winter M, Wechsler H. Age of first intoxication, heavy drinking, driving after drinking and risk of unintentional injury among U.S. college students. J Stud Alcohol. 2003 Jan;64(1):23-31.

ADDICTION IS A DISEASE OF ADOLESCENCE

TABLE 2. Study outcomes according to age first drunk: College students age 19 or older who ever got drunk, in percents[a]

	Age first drunk					
	≤12 (n = 281)	13-15 (n = 1,976)	16 (n = 1,837)	17 (n = 1,401)	18 (n = 1,737)	19+ (n = 1,519)
Alcohol dependent[a]	16	13	10	9	5	3
Heavy episodic drinking past 2 weeks[a]	64	70	66	63	53	39
Drove after drinking[a]	48	50	43	38	32	27
Drove after drinking 5+[a]	24	27	19	18	10	6
Rode with a driver who was high or drunk[a]	40	45	36	29	21	15
Injury past year requiring treatment within 6 hours of drinking[a]	4	4	3	2	2	<1
Injury past year requiring medical treatment (no drinking)[b]	18	14	13	13	14	13

[a]Relations $p < .001$. [b]Not significant. outcomes trend down with increasing age of first intoxication

Hingson R, Heeren T, Zakocs R, Winter M, Wechsler H. Age of first intoxication, heavy drinking, driving after drinking and risk of unintentional injury among U.S. college students. J Stud Alcohol. 2003 Jan;64(1):26.

Zips 2009 Season

- 25,000 seat, $70.6 Million InfoCision Stadium opens
- Multiple injuries
  - 24 players out for ≥ 8 games EACH due to injuries

- Weak second string
- Team continues to have a weak defense
- Tyler gets 31 tackles in 11 games
- Widespread use and addiction
  - According to Jeremy Bruce, wide receiver:
  - "After the games, some of the trainers pulled out a large jar and handed out oxycodone and hydrocodone pills – as many as a dozen to each player. Later in the week, a doctor would write players prescriptions for opiate painkillers, and send student aides to the pharmacy to fill them."
  - "'I would say fifteen to seventeen kids had a problem. It seems that most who had an addiction problem had an extensive problem with injuries as well.'"
- Season record: 3-9

Quinones, Sam. *Dreamland: The True Tale of America's Opiate Epidemic*. New York: Bloomsbury Press, 2015. 295-297.
The University of Akron, "InfoCision Stadium/Summa Field." New Building Projects. 2017. Accessed February 18, 2017. https://www.uakron.edu/capplan/new-building-projects.dot?planId=1843957.

Opioids are often taken in larger amounts or over a longer period than was intended.

American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. Vol. V. Washington, D.C.: American Psychiatric Association, 2013, 541.

Tyler's Play Declines

- During the 2009 season he isolates, asks parents for money, appears depressed
- After the season, his father orders a drug screen
  - Test is positive for opiates

Corvo, Kevin. "Heroin Leaves Broken Families in Its Wake." ThisWeek Community News. October 8, 2014. Accessed February 08, 2016. http://www.thisweeknews.com/content/stories/2014/10/02/HEROIN-STORIES/heroin-leaves-broken-families-in-its-wake.html.

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Recurrent opioid use resulting in a failure to fulfill major role obligations at work, school, or home.

American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. Vol. V. Washington, D.C.: American Psychiatric Association, 2013, 541.

Tyler's Play Declines

- During the 2009 season he isolates, asks parents for money, appears depressed
- After the season, his father orders a drug screen
  - Test is positive for opiates
- 12/2009, completes four of six weeks of outpatient treatment
  - Talbot Hall, OSU
- 3/2010 coach stages intervention

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There is a persistent desire or unsuccessful efforts to cut down or control opioid use.

American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. Vol. V. Washington, D.C.: American Psychiatric Association, 2013, 541.

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- During the 2009 season he isolates, asks parents for money, appears depressed
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  - Test is positive for opiates
- 12/2009, completes four of six weeks of outpatient treatment
  - Talbot Hall, OSU
- 3/2010 coach stages intervention

- Tyler withdraws from school for the term … and loses his scholarship
- Transfers to West Liberty University, but no longer goes to practice

Corvo, Kevin. "Heroin Leaves Broken Families in Its Wake." ThisWeek Community News. October 8, 2014. Accessed February 08, 2016. http://www.thisweeknews.com/content/stories/2014/10/02/HEROIN-STORIES/heroin-leaves-broken-families-in-its-wake.html.

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Continued opioid use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of opioids.

Important social, occupational, or recreational activities are given up or reduced because of opioid use.

American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. Vol. V. Washington, D.C.: American Psychiatric Association, 2013, 541

ADDICTION IS NOT A MORAL FAILURE

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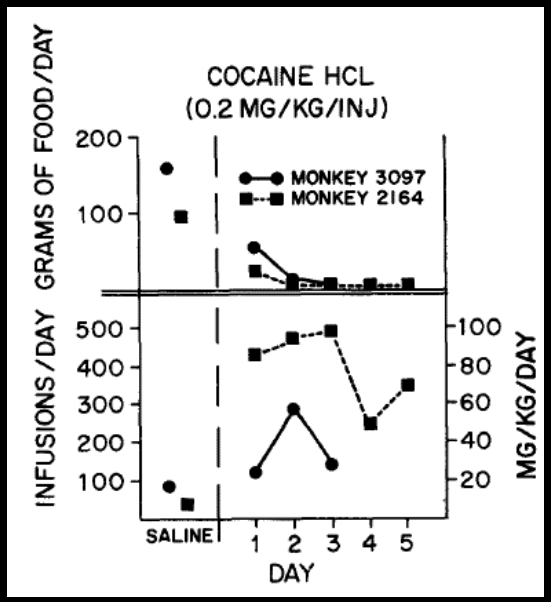
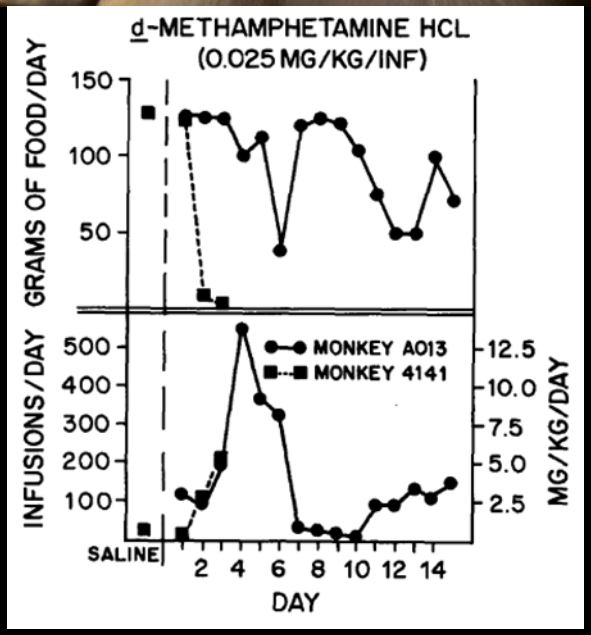


- Methods: Rhesus monkeys are allowed to press a lever to get an IV stimulant infusion 23 hours/day for 28-30 days
- Results:
  - "These animals became hyperactive, restless and often threw themselves against the walls of the cubicle when the door was opened by the experimenter. Most animals engaged in repetitive picking and scratching and extended their legs away from their bodies in a bizarre posture. They rocked back and forth for considerable periods of time and often appeared to be staring intently. In addition, tremors, mydriasis and pilo-erection were observed."
  - 2 monkeys get IV cocaine: both stopped eating by day 3. "Both animals were found comatose within 5 days of access and, despite attempts to revive them, both died within 24 hours."

Johanson CE, Balster RL, Bonese K. Self-administration of psychomotor stimulant drugs: the effects of unlimited access. Pharmacol Biochem Behav. 1976 Jan;4(1):45-51.

Image from: Sartore, Joel. "Rhesus Monkey." National Geographic. February 17, 2017. Accessed February 20, 2017. http://www.nationalgeographic.com/animals/mammals/r/rhesus-macaque/.

ADDICTION IS NOT A MORAL FAILURE



- Results:
  - 2 monkeys get d-methamphetamine: one monkey gets 561 infusions in one day. Both monkeys die by day 15.
- Conclusions:
  - "When given unlimited access, these animals self-administer highly toxic doses often resulting in death within a few days of availability."
  - "In general, food and drug intake were not correlated . . . . 6 of the 7 animals who died in 10 days or less of drug access had consumed very little food, a factor which may have contributed to their demise."

Johanson CE, Balster RL, Bonese K. Self-administration of psychomotor stimulant drugs: the effects of unlimited access. Pharmacol Biochem Behav. 1976 Jan;4(1):45-51.

Image from: Sartore, Joel. "Rhesus Monkey." National Geographic. February 17, 2017. Accessed February 20, 2017. http://www.nationalgeographic.com/animals/mammals/r/rhesus-macaque/.

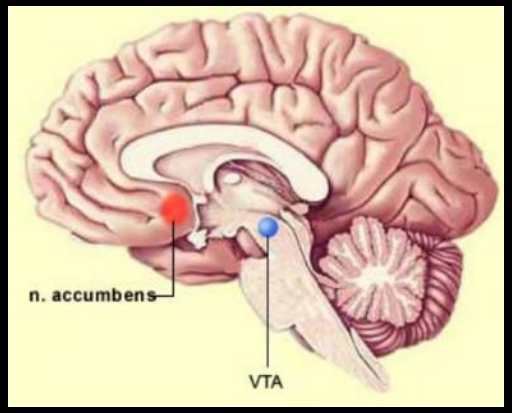
ADDICTION IS A BRAIN DISEASE

ADDICTION IS A BRAIN DISEASE

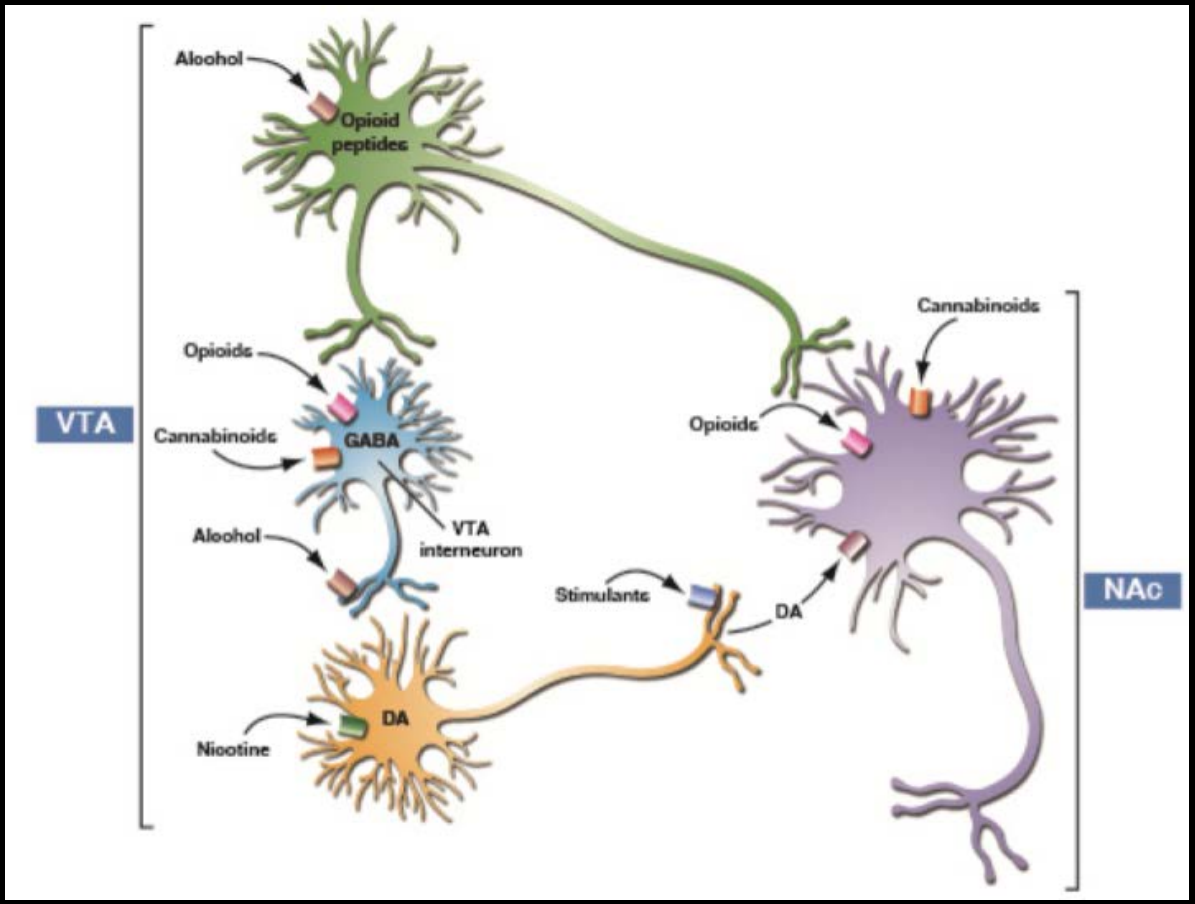
"Addiction is an incentive salience, reward deficit, stress surfeit, and executive function disorder."

Tasman, Allan, Kay, Jerald, and Lieberman, Jeffrey A., eds. Psychiatry. 2 Volume Set. Volumes 1-2 (4). Somerset, GB: Wiley-Blackwell. 2015. 371.

ADDICTION IS A BRAIN DISEASE

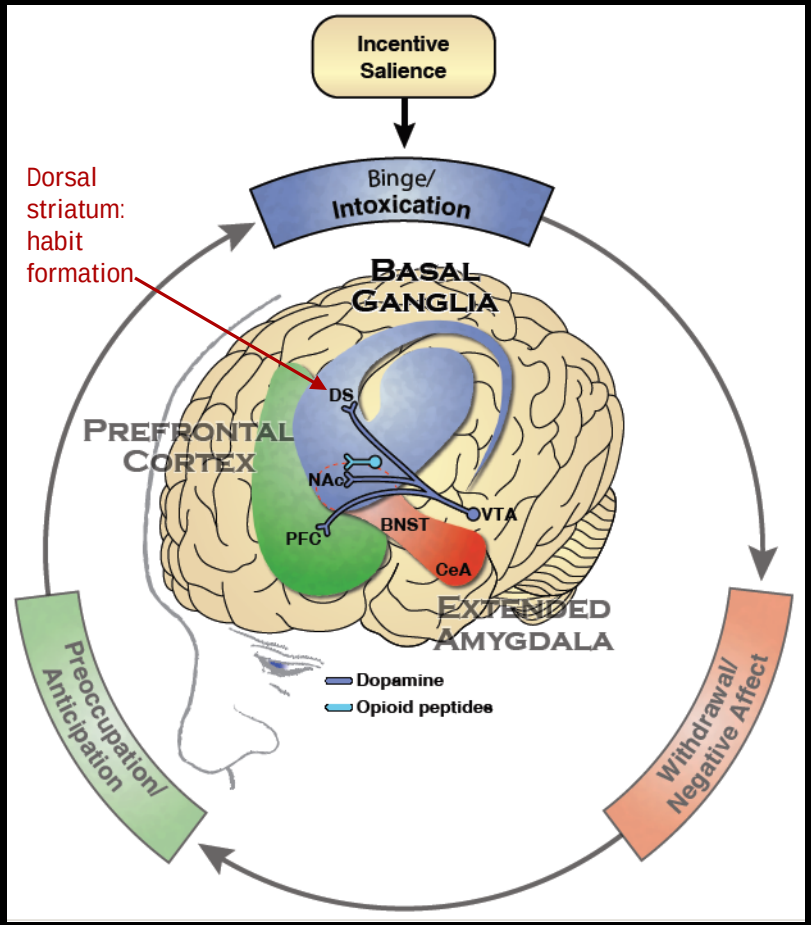


"There is virtually unanimous consensus in the field of addiction research that the rewarding effects of drugs are related to their ability to increase DA, particularly in the NAc."



Quote from: Volkow ND, Baler RD. Addiction science: Uncovering neurobiological complexity. Neuropharmacology. 2014 Jan;76. 6.
Image of brain cross-section from: "The Pleasure Centres." The Brain From Top To Bottom. Accessed February 18, 2017. http://thebrain.mcgill.ca/flash/d/d_03/d_03_cr/d_03_cr_que/d_03_cr_que.html.
U.S. Department of Health and Human Services (HHS), Office of the Surgeon General, Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health. Washington, DC: HHS, November 2016. 2-10.

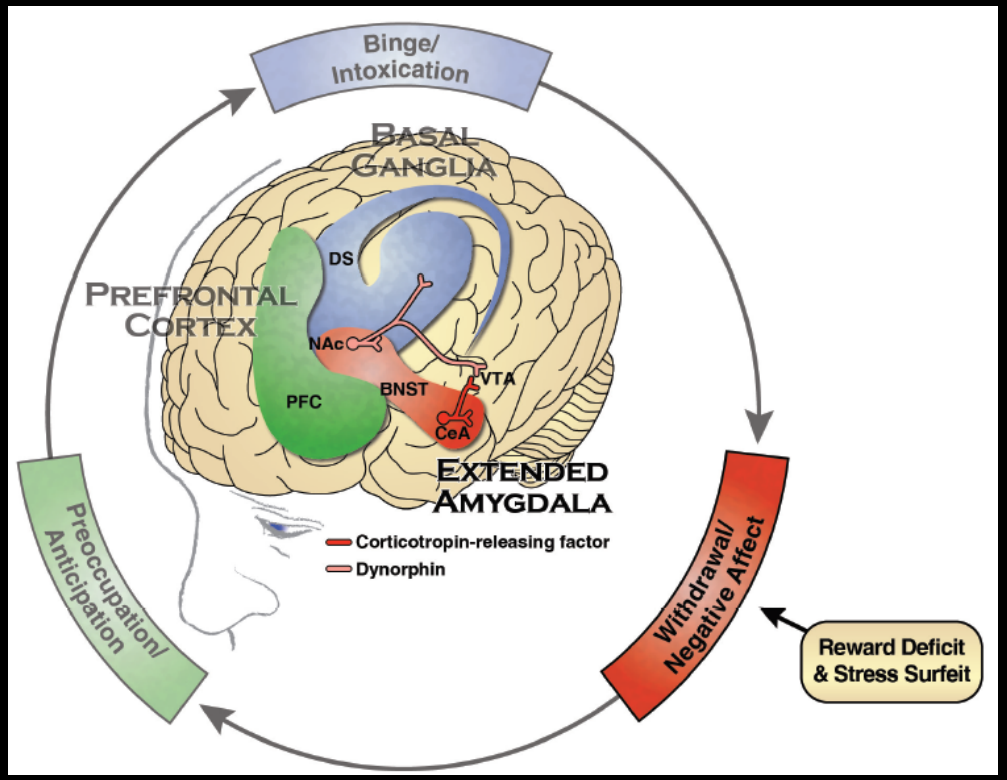
ADDICTION IS A BRAIN DISEASE



- 1) Binge/Intoxication
  - Drug taking leads to DA release and positive reinforcement
  - Incentive Salience
    - Drug-related cues lead to DA release, drug "wanting," and motivation to seek the drug

Volkow ND, Morales M. The Brain on Drugs: From Reward to Addiction. Cell. 2015 Aug 13;162(4):713-5.
U.S. Department of Health and Human Services (HHS), Office of the Surgeon General, Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health. Washington, DC: HHS, November 2016. 2-8-2-12.

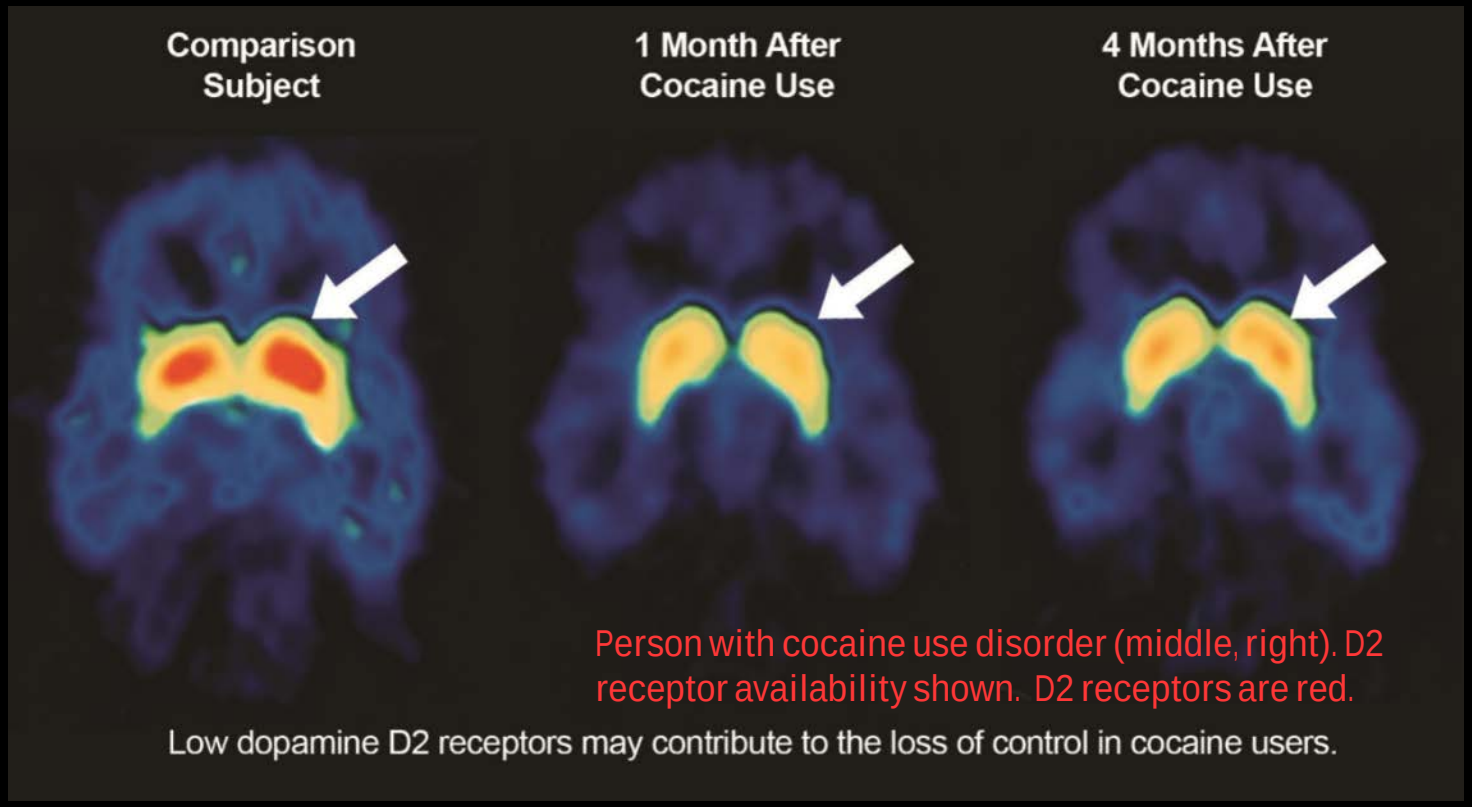
ADDICTION IS A BRAIN DISEASE



- 2) Withdrawal/ Negative Affect
  - Less activity in reward circuit

U.S. Department of Health and Human Services (HHS), Office of the Surgeon General, Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health. Washington, DC: HHS, November 2016. 2-15.

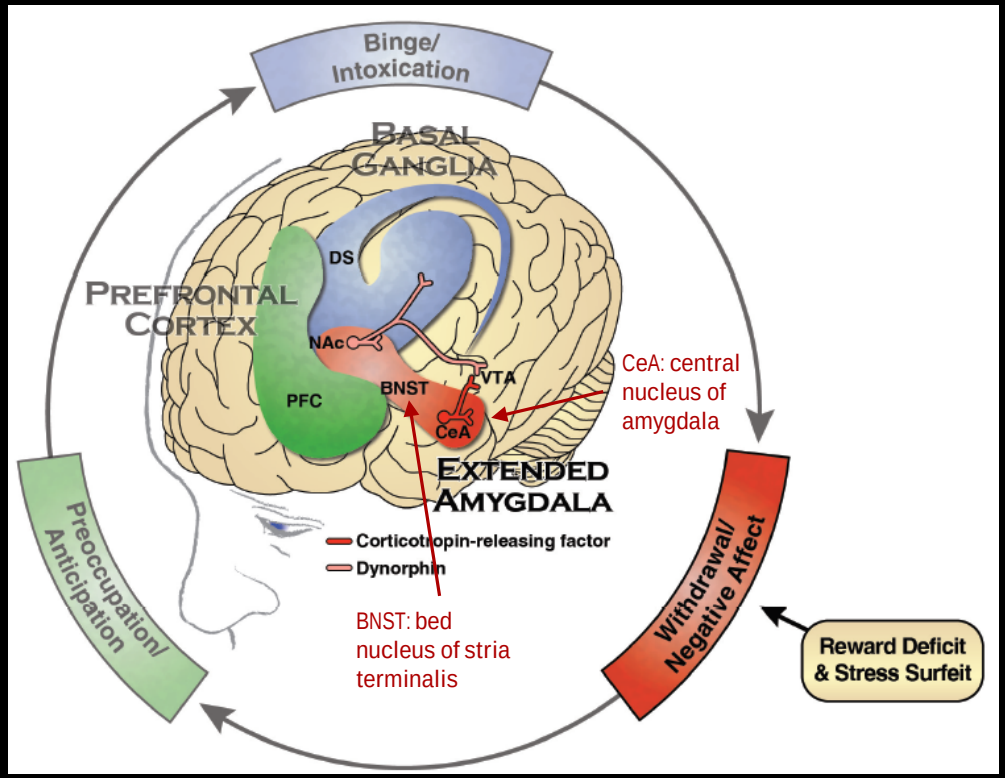
ADDICTION IS A BRAIN DISEASE



fMRI: person with cocaine use disorder has fewer D2 receptors in striatum. "In humans addicted to drugs, the reduction in striatal D2R is associated with decreased activity in the PFC as evidenced by decreases in baseline glucose metabolism (a marker of brain function)."

U.S. Department of Health and Human Services (HHS), Office of the Surgeon General, Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health. Washington, DC: HHS, November 2016. 2-14.
Quote from: Volkow ND, Baler RD. Addiction science: Uncovering neurobiological complexity. Neuropharmacology. 2014 Jan;76. 11.

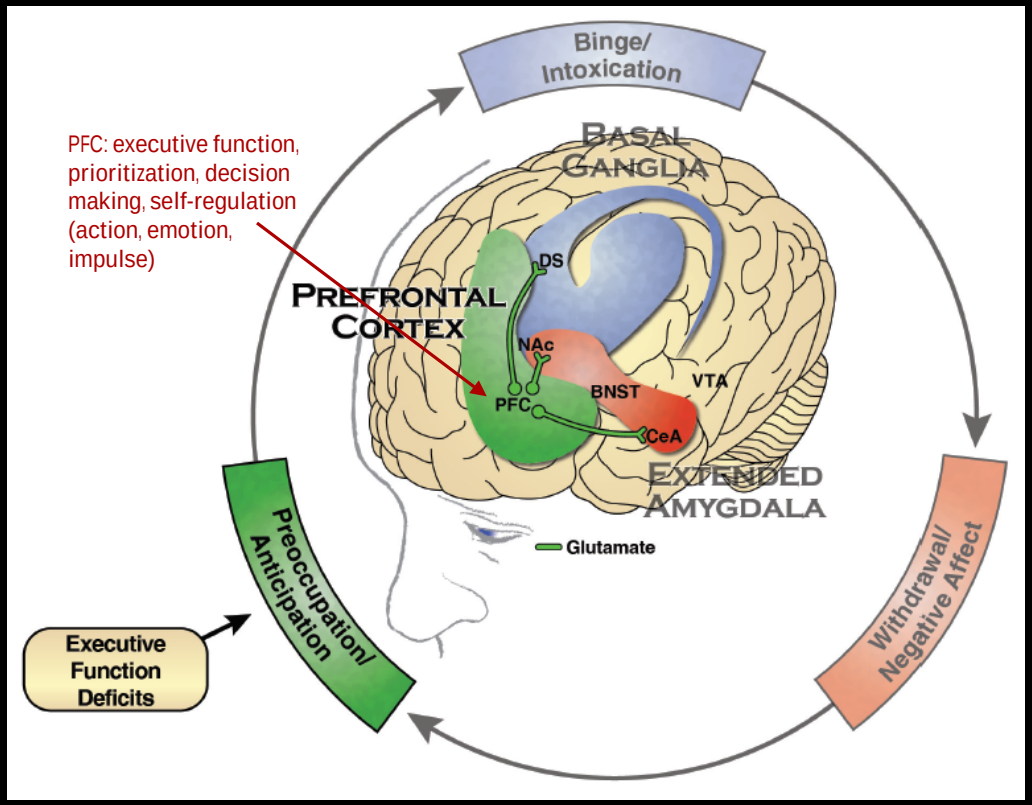
ADDICTION IS A BRAIN DISEASE



- 2) Withdrawal/ Negative Affect
  - Less activity in reward circuit
  - Stress neurotransmitters activated in extended amygdala: CRF, NE, dynorphin
    - Negative reinforcement
      - Use to in response to stress and withdrawal

U.S. Department of Health and Human Services (HHS), Office of the Surgeon General, Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health. Washington, DC: HHS, November 2016. 2-12-2-15.

ADDICTION IS A BRAIN DISEASE



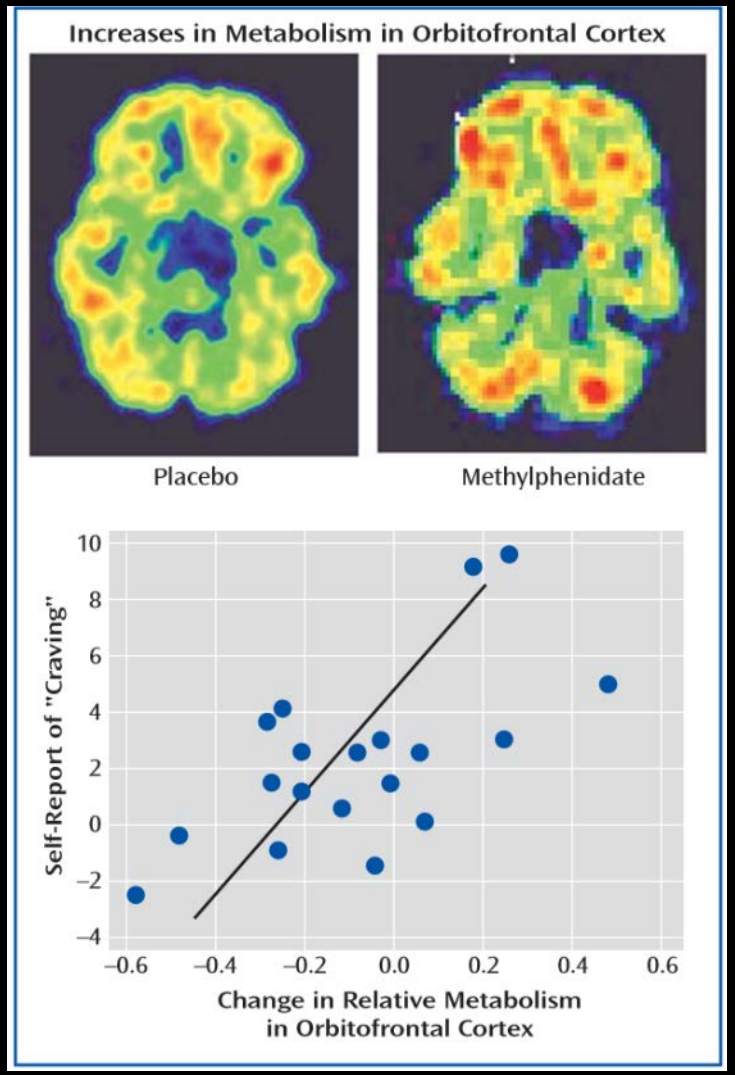
- 3) Preoccupation/ Anticipation)
- Dysfunction of the prefrontal cortex

U.S. Department of Health and Human Services (HHS), Office of the Surgeon General, Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health. Washington, DC: HHS, November 2016. 2-16-2-17.

ADDICTION IS A BRAIN DISEASE

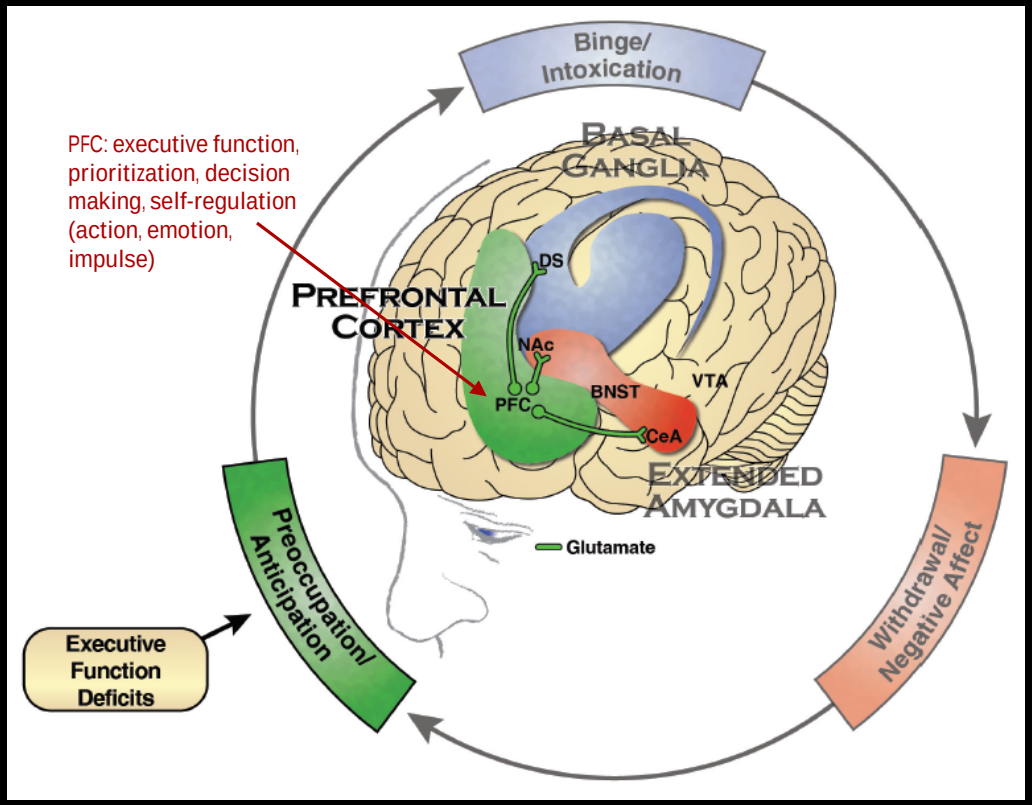
PET scan with decreased baseline metabolic activity in orbitofrontal cortex leading to less self-control, more impulsive and compulsive behavior. Radiotracer red > yellow > green > blue.

Methylphenidate given to cocaine-addicted subjects. PET scan shows increased metabolic activity in orbitofrontal cortex with drug craving.



Kalivas PW, Volkow ND. The neural basis of addiction: a pathology of motivation and choice. Am J Psychiatry. 2005 Aug;162(8):1406.
Koob GF, Volkow ND. Neurobiology of addiction: a neurocircuitry analysis. Lancet Psychiatry. 2016 Aug;3(8):766.
Koob GF, Volkow ND. Neurocircuitry of addiction. Neuropsychopharmacology. 2010 Jan;35(1):230.
Volkow ND, Fowler JS, Wang GJ. The addicted human brain: insights from imaging studies. J Clin Invest. 2003 May;111(10):1445.
Volkow ND, Morales M. The Brain on Drugs: From Reward to Addiction. Cell. 2015 Aug 13;162(4):716.

ADDICTION IS A BRAIN DISEASE



- 3) Preoccupation/ Anticipation)
- Dysfunction of the prefrontal cortex

Drug cue → Increased activity in PFC → NAc releases glutamate → Incentive salience (craving)

U.S. Department of Health and Human Services (HHS), Office of the Surgeon General, Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health. Washington, DC: HHS, November 2016. 2-16-2-17.

ADDICTION IS A BRAIN DISEASE

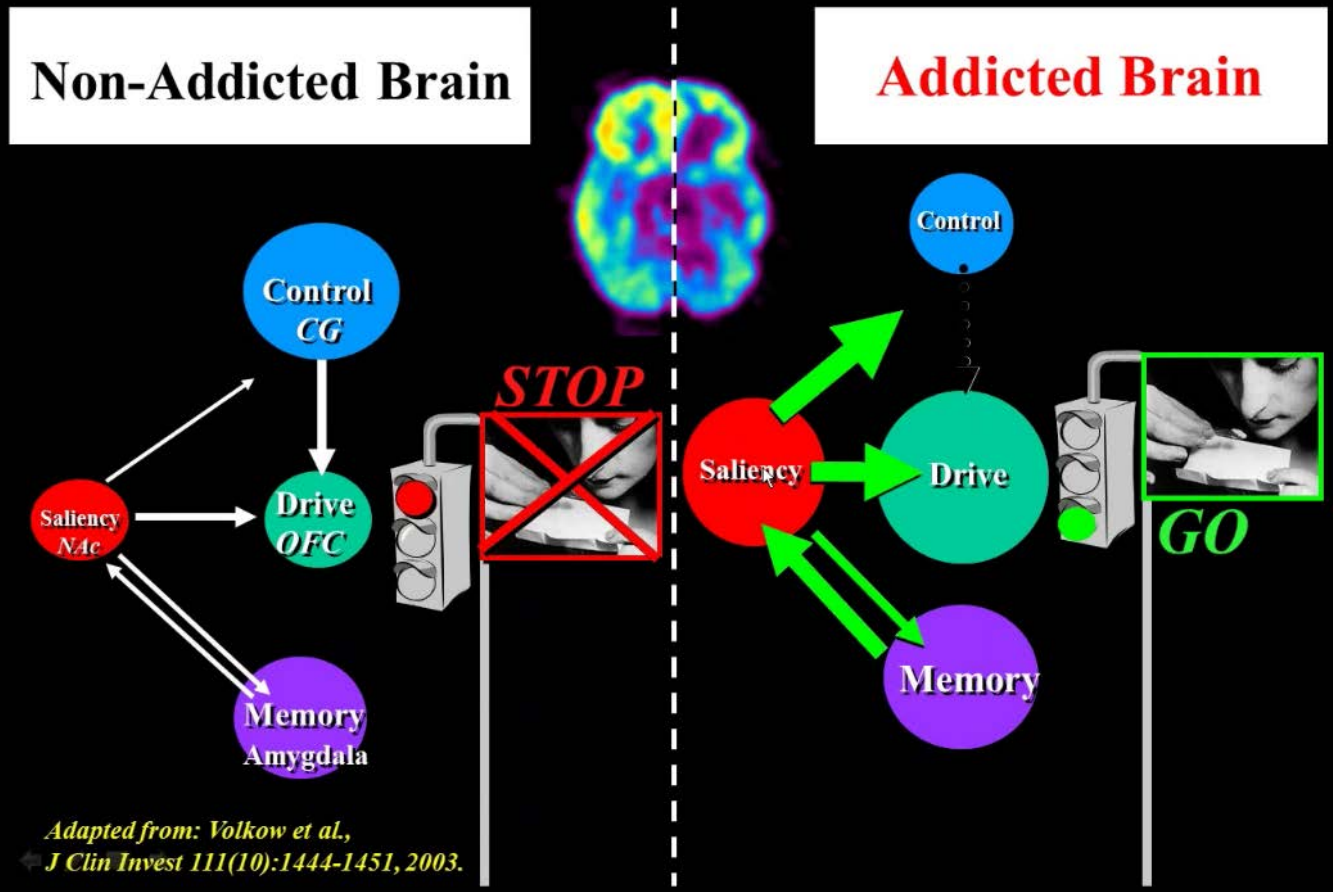


Image from Volkow, Nora. "Addiction as a Brain Disease: What Does it Mean?" Lecture, Meet the Scientist: A Virtual Q&A Discussion. Brain & Behavior Research Foundation. August 19, 2015. Lecture accessed online March 19, 2017.

Tyler's Play Declines

- During the 2009 season he isolates, asks parents for money, appears depressed
- After the season, his father orders a drug screen
  - Test is positive for opiates
- 12/2009, completes four of six weeks of outpatient treatment
  - Talbot Hall, OSU
- 3/2010 coach stages intervention
- Tyler withdraws from school for the term … and loses his scholarship
- Transfers to West Liberty University, but no longer goes to practice
- Cycle of relapse and treatment
- Attends four residential facilities

Corvo, Kevin. "Heroin Leaves Broken Families in Its Wake." ThisWeek Community News. October 8, 2014. Accessed February 08, 2016. http://www.thisweeknews.com/content/stories/2014/10/02/HEROIN-STORIES/heroin-leaves-broken-families-in-its-wake.html.

Rabinowtiz, Amanda. "Playing through Pain Sometimes Means a Deadly Addiction for Athletes." WKSU. April 24, 2012. Accessed February 18, 2017. http://wksu.org/news/story/31460.

Valade, Jodie. "Football Could Not save Chris Jacquemain and Tyler Campbell from Painkiller Addiction." Cleveland.com. February 12, 2012. Accessed February 18, 2017. http://www.cleveland.com/sports/college/index.ssf/2012/02/football_could_not_save_chris.html.

ADDICTION IS A CHRONIC DISEASE

ADDICTION IS A CHRONIC DISEASE

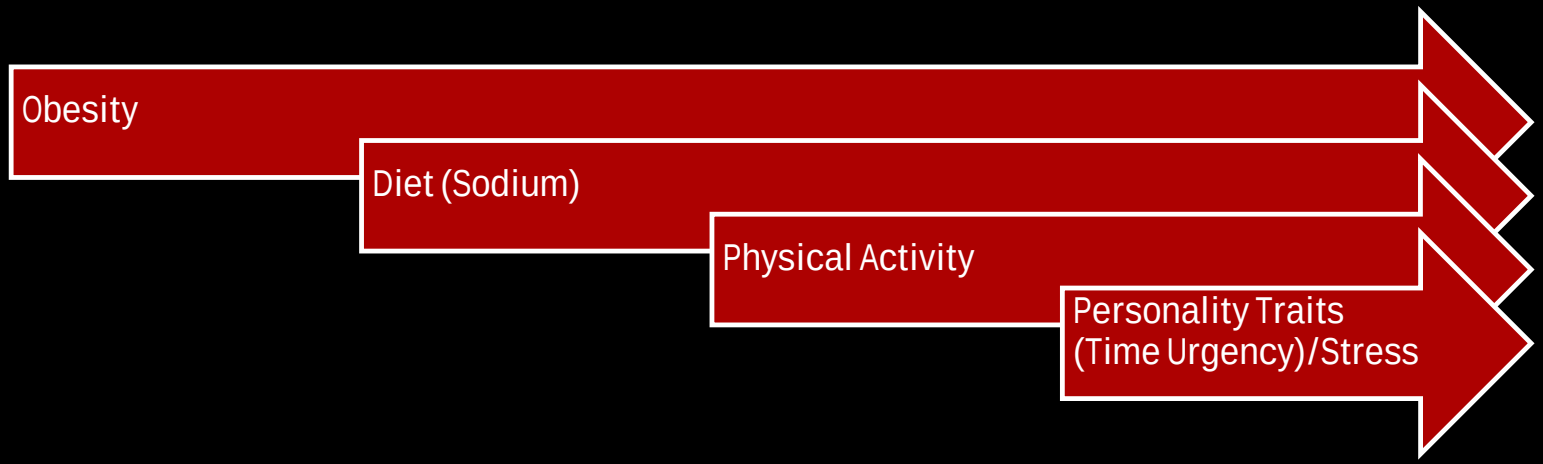
Heritability from twin studies

	Dependence
Hypertension: 0.25-0.5	Heroin, males: 0.34
DM1: 0.3-0.55	Alcohol, males: 0.55
DM2: 0.8	Marijuana, females: 0.52
Asthma: 0.36-0.7	Tobacco, both sexes: 0.61

McLellan AT, Lewis DC, O'Brien CP, Kleber HD. Drug dependence, a chronic medical illness: implications for treatment, insurance, and outcomes evaluation. JAMA. 2000 Oct 4;284(13):1690.

ADDICTION IS A CHRONIC DISEASE

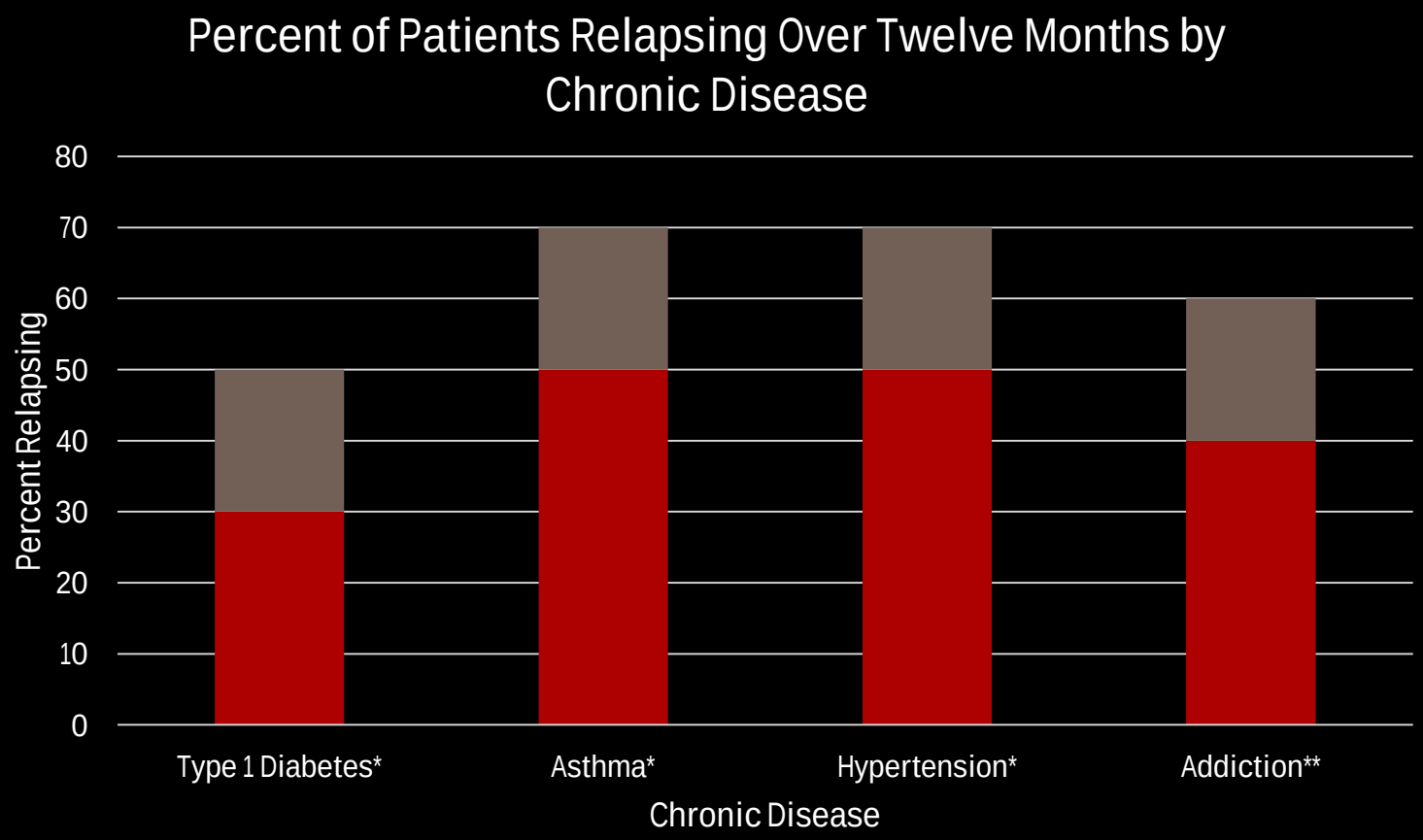
Behavior contributes to disease development



Basile, Jan, and Michael J. Bloch. "Overview of hypertension in adults." March 2, 2016. Accessed February 03, 2017. https://www.uptodate.com/contents/overview-of-hypertension-in-adults?source=search_result&search=hypertension&selectedTitle=1~150#H8.

McLellan AT, Lewis DC, O'Brien CP, Kleber HD. Drug dependence, a chronic medical illness: implications for treatment, insurance, and outcomes evaluation. JAMA. 2000 Oct 4;284(13):1690.

ADDICTION IS A CHRONIC DISEASE



"Problems of poverty, lack of family support, and psychiatric comorbidity were major and approximately equal predictors of non-compliance and relapse across all chronic illnesses examined."

* Relapse is "recurrence of symptoms each year to the point where they require additional medical care to reestablish symptom remission."
** "1-year, postdischarge follow-up studies" of continuous abstinence

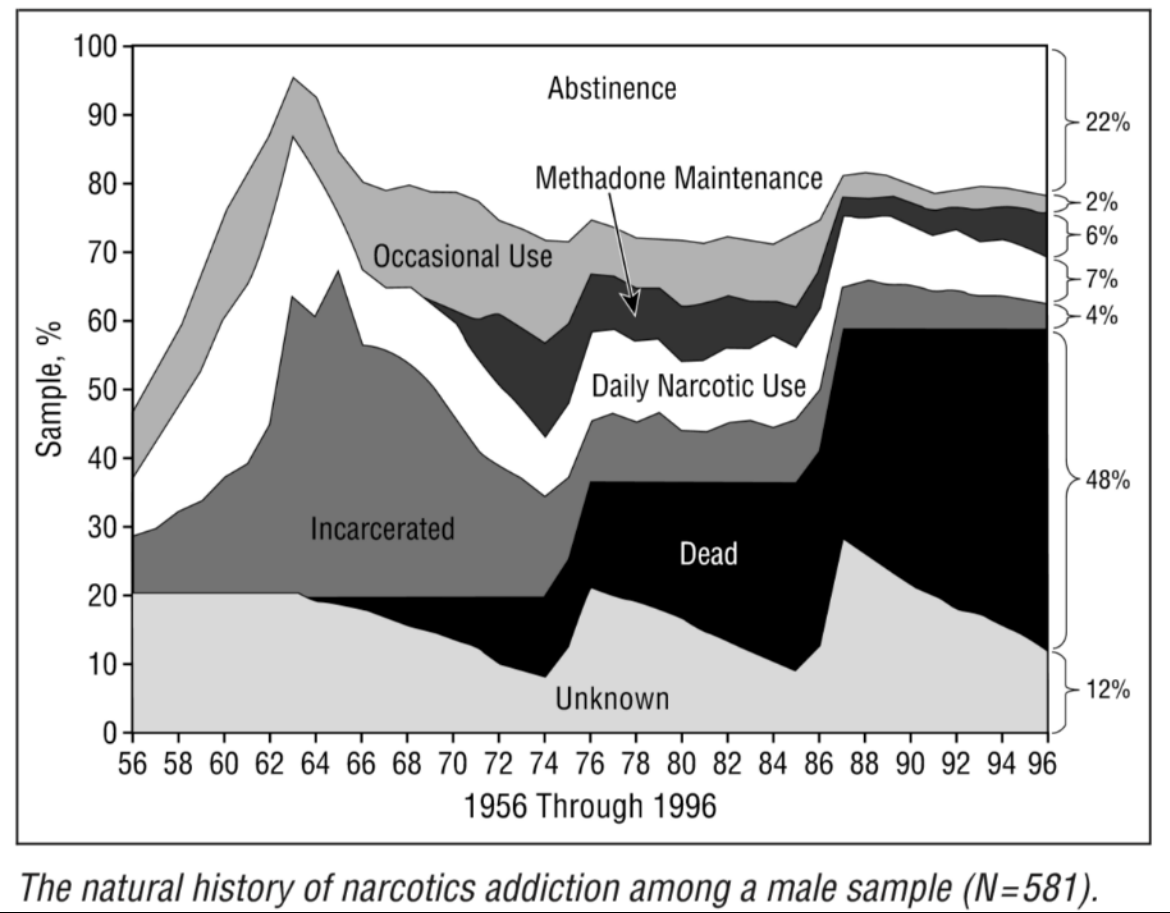
McLellan AT, Lewis DC, O'Brien CP, Kleber HD. Drug dependence, a chronic medical illness: implications for treatment, insurance, and outcomes evaluation. JAMA. 2000 Oct 4;284(13):1693-1694.
National Institute on Drug Abuse. "Drug Abuse & Addiction." Lecture, Viewed February 5, 2017. https://www.drugabuse.gov/sites/default/files/addictionscience.ppt

ADDICTION IS A CHRONIC DISEASE

"It is interesting that relapse among patients with diabetes, hypertension, and asthma following cessation of treatment has been considered evidence of the effectiveness of those treatments and the need to retain patients in medical monitoring. In contrast, relapse to drug or alcohol use following discharge from addiction treatment has been considered evidence of treatment failure."

McLellan AT, Lewis DC, O'Brien CP, Kleber HD. Drug dependence, a chronic medical illness: implications for treatment, insurance, and outcomes evaluation. JAMA. 2000 Oct 4;284(13):1694.

ADDICTION IS A CHRONIC DISEASE



The natural history of narcotics addiction among a male sample (N=581).

- Methods: 33-year follow-up of 581 male "heroin addicts" in a "compulsory drug treatment program for heroin-dependent criminal offenders" in California. Patients were evaluated with face-to-face interviews and urine drug screens over three, ten-year intervals.
- Population at 1996/1997 interview: 56.2% Hispanic, > 80% arrested prior to age 18, > 60% tried heroin before age 20
- Response rate: 242 living and interviewed in 1996/1997

Hser YI, Hoffman V, Grella CE, Anglin MD. A 33-year follow-up of narcotics addicts. Arch Gen Psychiatry. 2001 May;58(5):503-8.

ADDICTION IS A CHRONIC DISEASE

- FINDINGS:
- Accidental poisoning/drug overdose is the most common cause of death (21.6%)
- Less than one half (46.7%) are abstinent > 5 years
- "By age 50 to 60 years, only about half of the 242 interviewed subjects tested negative for heroin."
- *"Overall, the group showed remarkably stable use patterns."*

Hser YI, Hoffman V, Grella CE, Anglin MD. A 33-year follow-up of narcotics addicts. Arch Gen Psychiatry. 2001 May;58(5):503-8.

Tyler's Play Declines

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- Cycle of relapse and treatment
- Attends four residential facilities
- Transitions to heroin

Corvo, Kevin. "Heroin Leaves Broken Families in Its Wake." ThisWeek Community News. October 8, 2014. Accessed February 08, 2016. http://www.thisweeknews.com/content/stories/2014/10/02/HEROIN-STORIES/heroin-leaves-broken-families-in-its-wake.html.

Rabinowtiz, Amanda. "Playing through Pain Sometimes Means a Deadly Addiction for Athletes." WKSU. April 24, 2012. Accessed February 18, 2017. http://wksu.org/news/story/31460.

Valade, Jodie. "Football Could Not save Chris Jacquemain and Tyler Campbell from Painkiller Addiction." Cleveland.com. February 12, 2012. Accessed February 18, 2017. http://www.cleveland.com/sports/college/index.ssf/2012/02/football_could_not_save_chris.html.

Tolerance

American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. Vol. V. Washington, D.C.: American Psychiatric Association, 2013, 541.

ADDICTION IS DIAGNOSABLE

Major Depressive Disorder

Five or more of the following symptoms have been present and documented during the same two-week period and represent a change from previous functioning; at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure.

1. Depressed mood most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad, empty, hopeless) or observation made by others (e.g., appears tearful)
2. Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day (as indicated by either subjective account or observation)
3. Significant weight loss when not dieting or weight gain (e.g., a change of more than 5% of body weight in a month), or decrease or increase in appetite nearly every day
4. Insomnia or hypersomnia nearly every day
5. Psychomotor agitation or retardation nearly every day (observable by others, not merely subjective feelings of restlessness or being slowed down)
6. Fatigue or loss of energy nearly every day
7. Feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick)
8. Diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others)
9. Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide

American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. Vol. V. Washington, D.C.: American Psychiatric Association, 2013, 160-161.

Opioid Use Disorder

A problematic pattern of opioid use leading to clinically significant impairment or distress, as manifested by at least two of the following, occurring within a 12-month period:

1. Opioids are often taken in larger amounts or over a longer period than was intended.
2. There is a persistent desire or unsuccessful efforts to cut down or control opioid use.
3. A great deal of time is spent in activities necessary to obtain the opioid, use the opioid, or recover from its effects.
4. Craving, or a strong desire or urge to use opioids.
5. Recurrent opioid use resulting in a failure to fulfill major role obligations at work, school, or home.
6. Continued opioid use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of opioids.
7. Important social, occupational, or recreational activities are given up or reduced because of opioid use.
8. Recurrent opioid use in situations in which it is physically hazardous.
9. Continued opioid use despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance.
10. Tolerance
11. Withdrawal

Mild: Presence of 2–3 symptoms. Moderate: Presence of 4–5 symptoms. Severe: Presence of 6 or more symptoms.

American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. Vol. V. Washington, D.C.: American Psychiatric Association, 2013, 541-542

MEDICINE IMPROVES OUTCOMES

MEDICINE IMPROVES OUTCOMES

Q: Why use medicine for opioid use disorder?

A: 70-90% of patients relapse without medicine.

Williams AR, Bisaga A. From AIDS to Opioids - How to Combat an Epidemic. N Engl J Med. 2016 Sep;375(9):814.

MEDICINE IMPROVES OUTCOMES

Methadone for Opioid Use Disorder

- Decreases opioid and other drug use
- Decreases criminal activity
- Decreases HIV, hepatitis B/C transmission
- Decreases opioid overdose and all-cause mortality
- Improves treatment retention
- Improves employment
- Cost-effective

American Society of Addiction Medicine. "Quality & Practice: Complete ASAM Guideline." June 1, 2015. Accessed September 25, 2016. http://www.asam.org/docs/default-source/practice-support/guidelines-and-consensus-docs/asam-national-practice-guideline-supplement.pdf?sfvrsn=24. Link to The ASAM National Practice Guideline For the Use of Medications in the Treatment of Addiction Involving Opioid Use found on referenced website.

Center for Substance Abuse Treatment. Medication-Assisted Treatment for Opioid Addiction in Opioid Treatment Programs. Treatment Improvement Protocol (TIP) Series 43. HHS Publication No. (SMA) 12-4214. Rockville, MD: Substance Abuse and Mental Health Services Administration, 2005. Accessed September 25, 2016. http://store.samhsa.gov/shin/content//SMA12-4214/SMA12-4214.pdf.

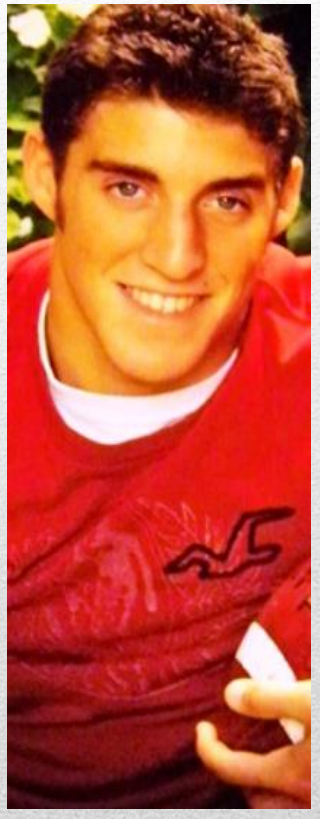
Krambeer, Laurie Limpitlaw, William Von McKnelly, Jr., William Gabrielli, Jr., and Elizabeth C. Penick. "Methadone Therapy for Opioid Dependence." American Family Physician. June 15, 2001. Accessed September 25, 2016. http://www.aafp.org/afp/2001/0615/p2404.html.

National Institute on Drug Abuse. "Medication-Assisted Treatment for Opioid Addiction." Topics in Brief. April 2012. Accessed September 25, 2016. https://www.drugabuse.gov/sites/default/files/tib_mat_opioid.pdf.

National Institutes of Health, Office of the Director. "The National Institutes of Health (NIH) Consensus Statement: Effective Medical Treatment of Opiate Addiction." Office of Disease Prevention Archive. November 19, 1997. Accessed September 24, 2016. https://consensus.nih.gov/1997/1998treatopiateaddiction108html.htm.

World Health Organization. "Treatment of Opioid Dependence." Management of Substance Abuse. 2016. Accessed September 25, 2016. http://www.who.int/substance_abuse/activities/treatment_opioid_dependence/en/.

Tyler Leaves Rehab



Spends 30 days in a residential facility in Cleveland. Drives home with his mom “optimistic about the future, talking about being a drug counselor.”

Quinones, Sam. *Dreamland: The True Tale of America's Opiate Epidemic*. New York: Bloomsbury Press, 2015. 297.
Rabinowtiz, Amanda. "Playing through Pain Sometimes Means a Deadly Addiction for Athletes." WKSU. April 24, 2012. Accessed February 18, 2017. http://wksu.org/news/story/31460.

Tyler Wayne Campbell

Obituary

CAMPBELL Tyler Wayne Campbell, 23, passed away unexpectedly at his home on July 22, 2011. Tyler was born on May 25, 1988, to Wayne and Christy Campbell in Pickerington, Ohio. Tyler was a loving and kind boy who was dedicated to his family He loved sports of all kinds, especially football. He had a special love for fishing and his animals. Tyler was a 2007 graduate of Pickerington High School North where he excelled in academics, football and baseball. Tyler accomplished his dream of playing Division I football after earning a scholarship to the University of Akron. Tyler was an active member of the Sycamore Creek Church in Pickerington. He was preceded in death by his paternal grandmother JoAnn Rose Janetski, "Nanny." Tyler is survived by his parents, Wayne and Christy Campbell of Pickerington; and 2 brothers, Ryan Matthew and Alex Christopher Campbell. He is also survived by paternal grandparents, Earnie and Hazel Campbell; maternal grandparents, Bernice Frazier, Guy and Wilma Cowden; his aunts, Debi, Kimmy, Martha, Jodi, Michelle, and Natalie; his uncles, Dusty, Patrick, Philo, Todd and Dave; and 13 cousins. Visitation will be held at Peace United Methodist Church in Pickerington on Wednesday, July 27 from 5-8 p.m. and Thursday, July 28 from 5-8 p.m., with funeral services following at 8 p.m. on Thursday. Pastor Josh Remy officiating. Contributions in Tyler's name may be made to 5/3rd Bank to the Tyler Campbell Memorial Fund For Drug Prevention. Condolences at www.spencefuneralhome.com

Published in The Columbus Dispatch on July 24, 2011

Guest Book

158 entries | 1 photo

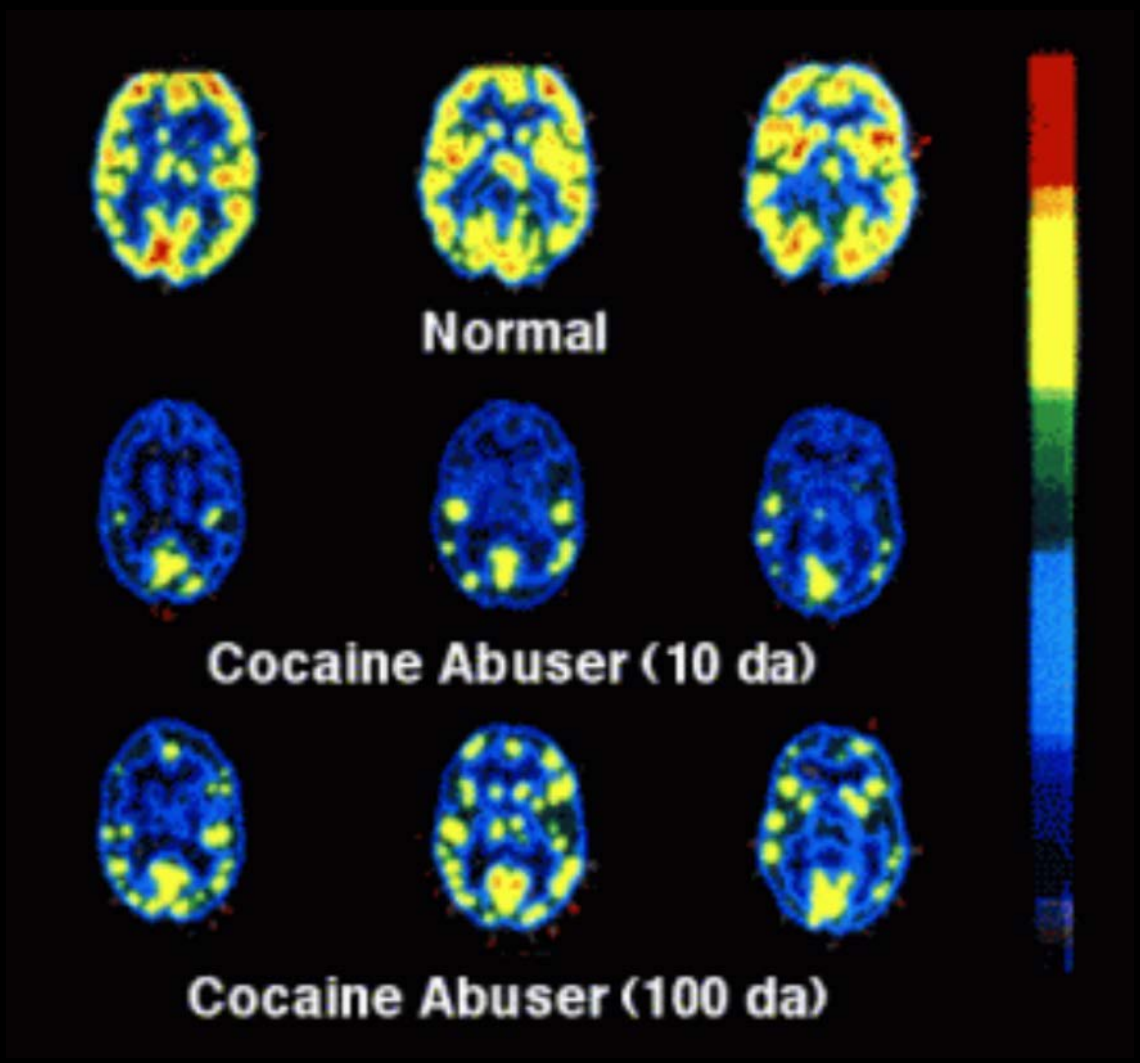
The Guest Book is expired.

Restore the Guest Book

"Tyler Wayne Campbell's Obituary on The Columbus Dispatch." The Columbus Dispatch. July 24, 2011. Accessed February 18, 2017. http://www.legacy.com/obituaries/dispatch/obituary.aspx?pid=152691404.

THE BRAIN TAKES TIME TO HEAL

THE BRAIN TAKES TIME TO HEAL

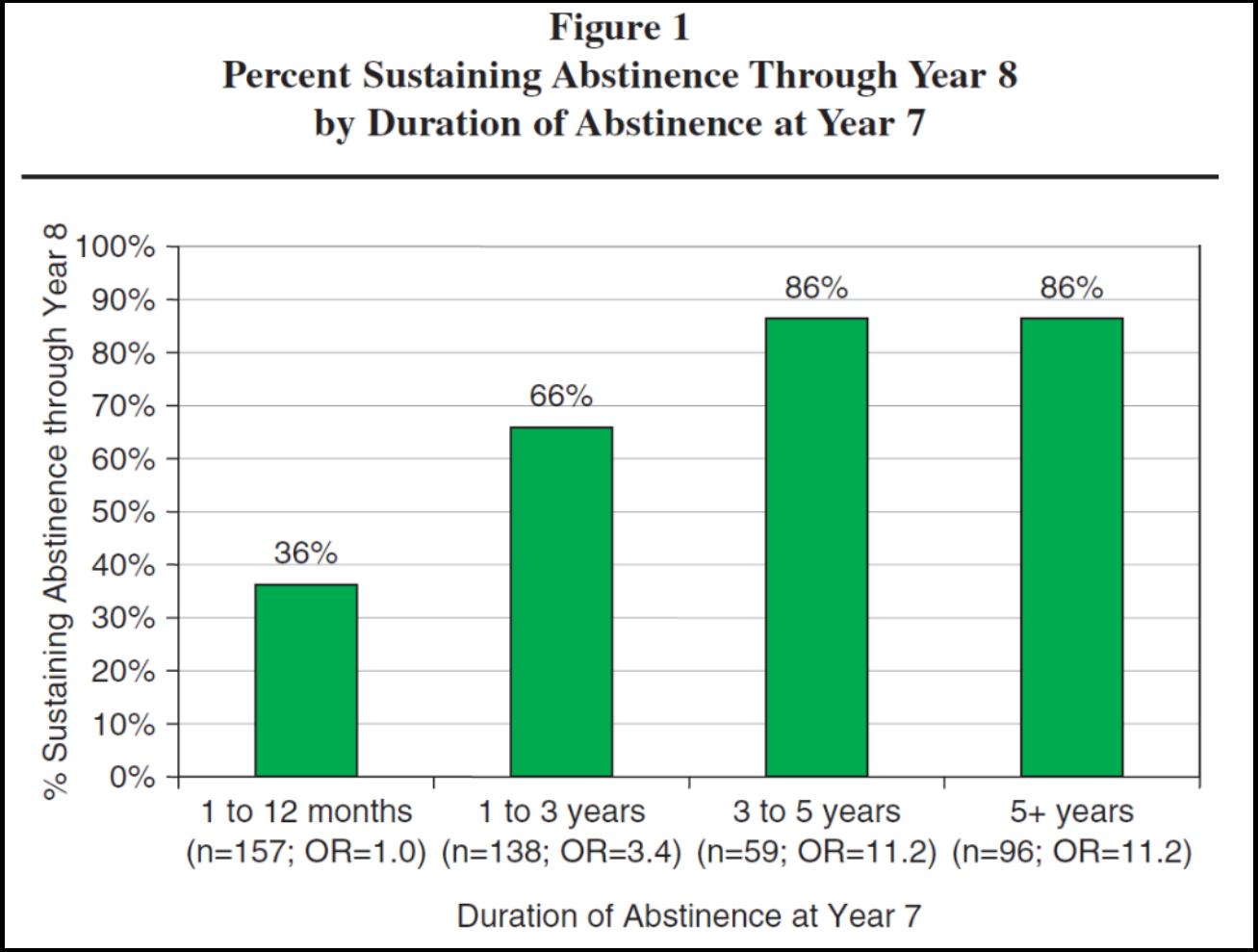


Brain function as seen in PET scans 10 and 100 days after last cocaine use in persons with stimulant use disorder. Yellow indicates normal brain function.

"4: Long-Term Effects of Drug Abuse." Bringing the Power of Science to Bear on Drug Abuse and Addiction. January 2007. Accessed February 11, 2017. https://www.drugabuse.gov/publications/teaching-packets/power-science/section-ii/4-long-term-effects-drug-abuse.

THE BRAIN TAKES TIME TO HEAL

"How does the likelihood of sustaining abstinence another year vary by the duration of abstinence?"



- Methods: observational 8-year study of 501 people ≥ 18 years old in Chicago seeking substance use disorder treatment from a publicly funded treatment program in 1998. Interviews and urine drug screens done at 6 months and then yearly for 7 years
- Population: 89% African American, 61% female, 68% 30-49 years, 84% unemployed, 53% HS diploma or GED, 38% homeless
- N = 450 with at least one month of abstinence at year 7 interview

Dennis ML, Foss MA, Scott CK. An eight-year perspective on the relationship between the duration of abstinence and other aspects of recovery. Eval Rev. 2007 Dec;31(6):585-612.

PEOPLE RECOVER

PEOPLE RECOVER

"Approximately 50 percent of adults who once met diagnostic criteria for a substance use disorder—or about 25 million people—are currently in stable remission (1 year or longer)."

U.S. Department of Health and Human Services (HHS), Office of the Surgeon General, Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health. Washington, DC: HHS, November 2016. 5-2.