The Adolescent Brain on Drugs

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Advanced Recovery Systems

Addiction: The Great Masquerader

IT CAN LOOK LIKE ANYTHING

- Affective Disorders
- Anxiety Disorders
- Personality Disorders
- Psychotic Disorders
- Organic and Neurological Disorders

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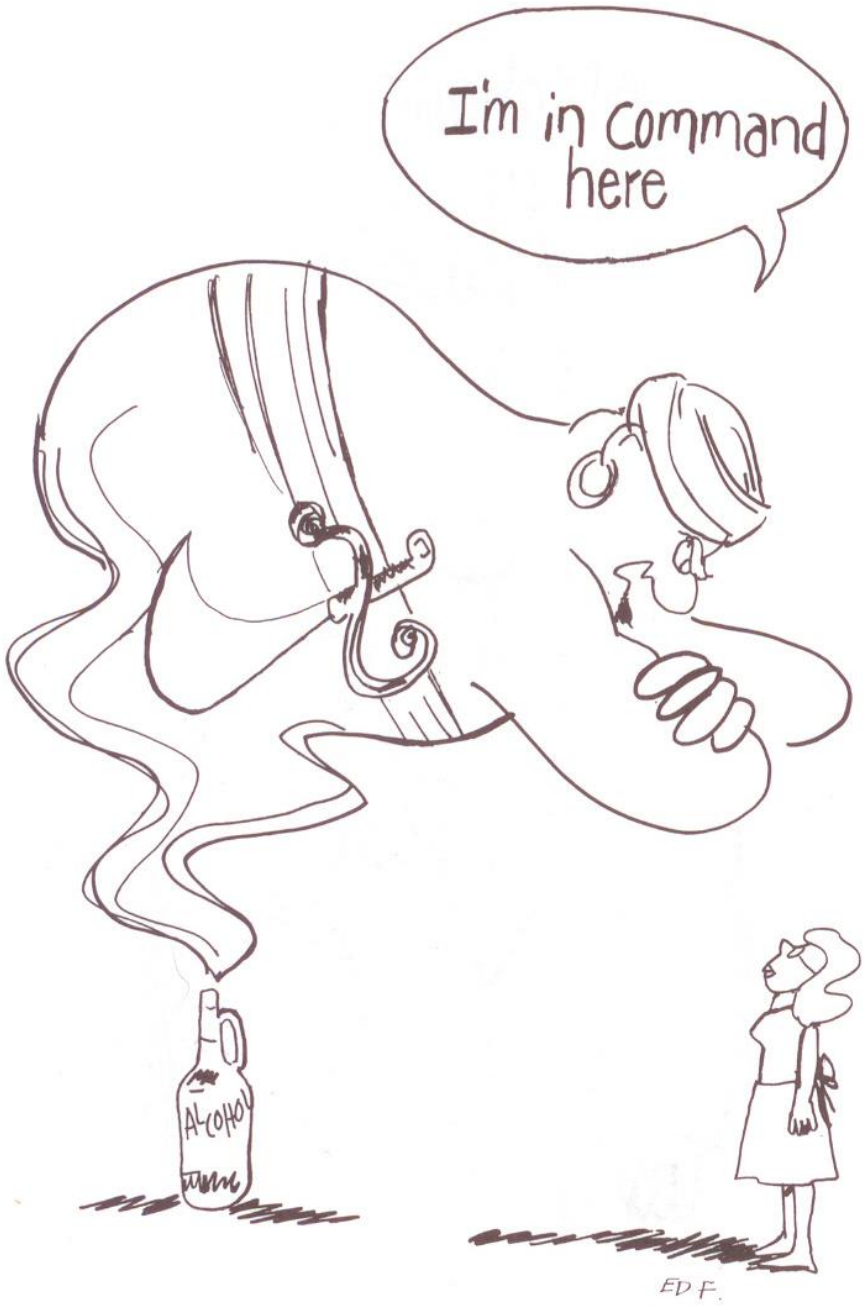
I'm in command here
ALCOHOL
ED F.

ASAM Definition 2014

- Addiction is a primary, chronic disease of brain reward, motivation, memory and related circuitry.
- Dysfunction in these circuits leads to characteristic biological, psychological, social and spiritual manifestations.
- This is reflected in an individual pathologically pursuing reward and/or relief by substance use and other behaviors.

ASAM Definition 2014

- Addiction is characterized by inability to consistently abstain, impairment in behavioral control, craving, diminished recognition of significant problems with one's behaviors and interpersonal relationships, and a dysfunctional emotional response.
- Like other chronic diseases, addiction often involves cycles of relapse and remission.
- Without treatment or engagement in recovery activities, addiction is progressive and can result in disability or premature DEATH.

DSM-V Definition: Substance Use Disorders

1. Using larger amounts or over a longer period of time than intended.
2. Persistent desire or unsuccessful efforts to cut down or control
3. Great deal of time spent in obtaining, using, and recovering from
4. Craving or a strong desire or urge to use
5. Recurrent use resulting in failure to fulfill major role obligations
6. Continued use despite persistent or recurrent social or interpersonal problems caused or exacerbated by use
7. Important social, occupational, or recreational activities are given up or reduced because of use
8. Recurrent use in physically hazardous situations
9. Continued use despite knowledge of having a persistent or recurrent physical or psychological problems that is caused or exacerbated by use.
10. Tolerance defined by need for increased amounts to achieve desired effect or markedly diminished effect with continued use of the same amount
11. Withdrawal either with withdrawal symptoms, or continued use to relieve or avoid withdrawal

DSM-V Definition: Substance Use Disorder

Mild: Presence of 2-3 symptoms

Moderate: Presence of 4-5 symptoms

Severe: Presence of 6 or more symptoms

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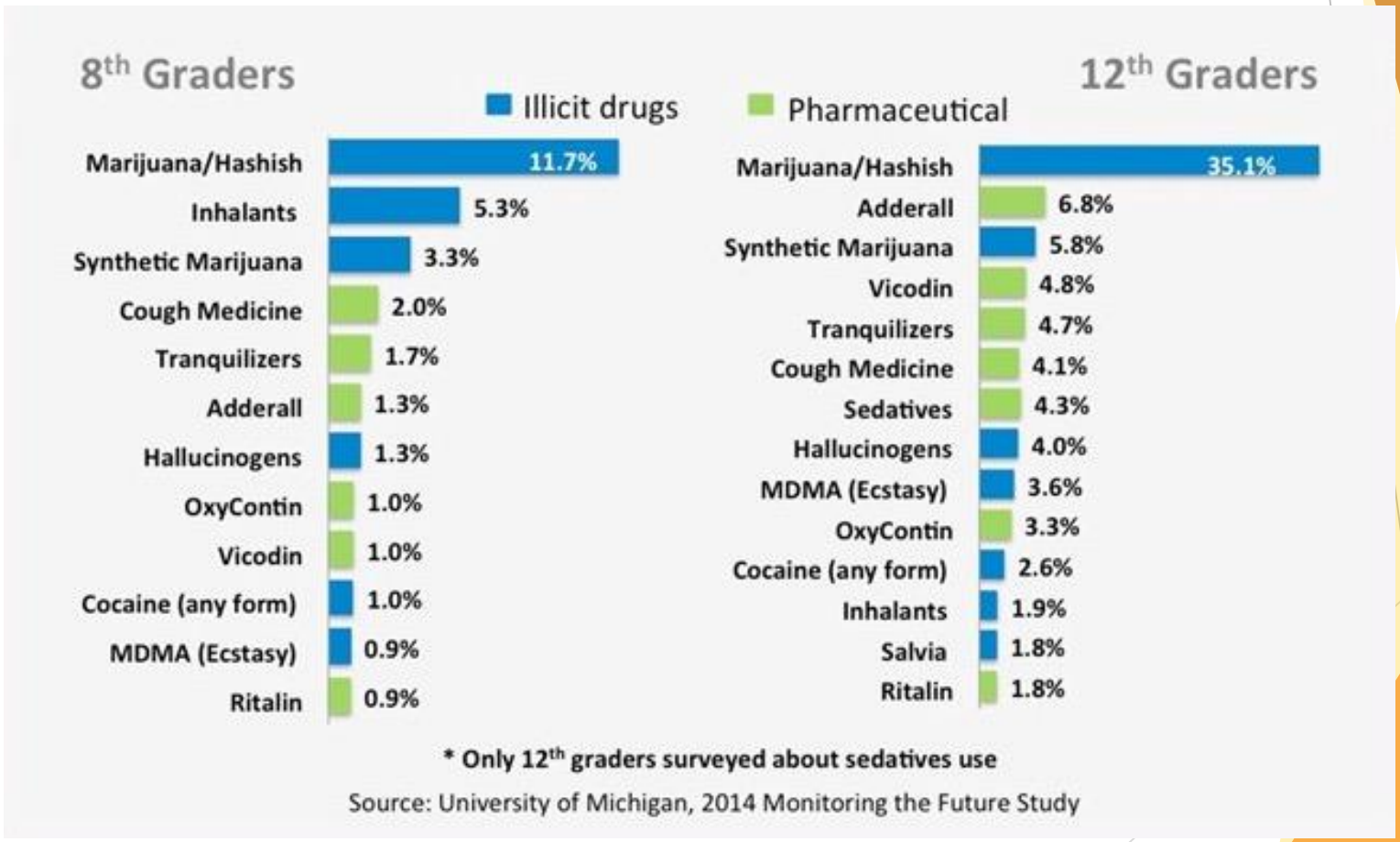
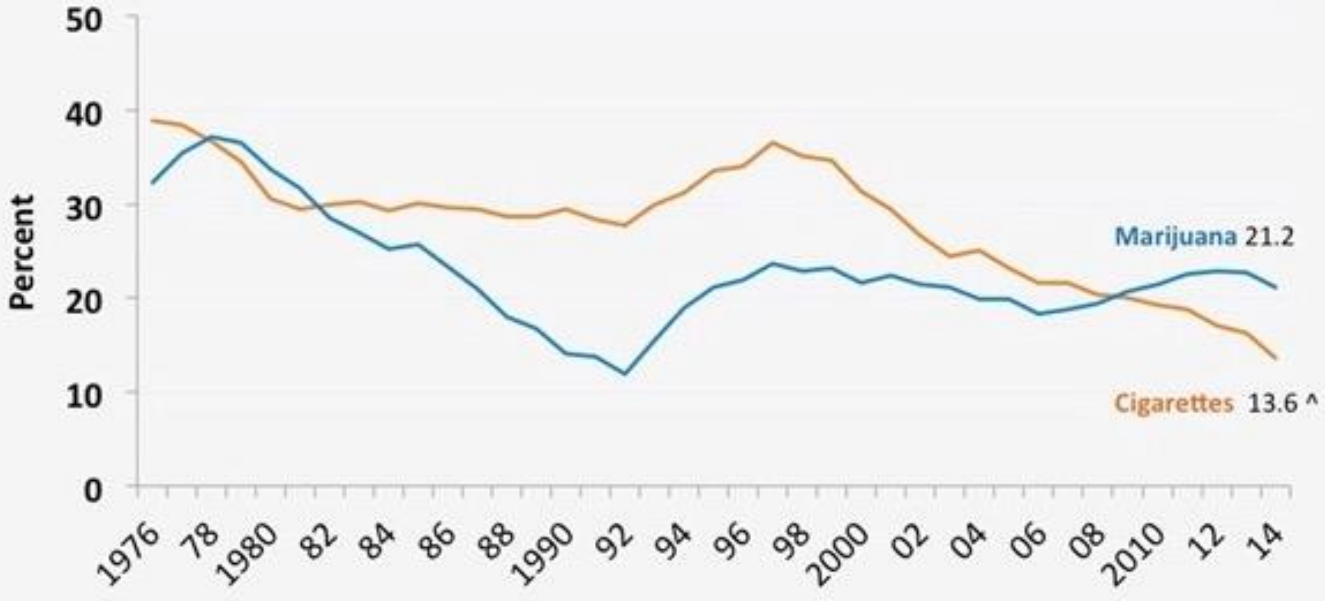
Top Drugs among 8th and 12th Graders, Past Year Use



Cigarettes (MTF 2014)

- Daily cigarette smoking has decreased markedly over the past five years (almost 50 percent) across all grades
- For eighth graders, it dropped to 1.4 percent compared to 2.7 percent five years ago

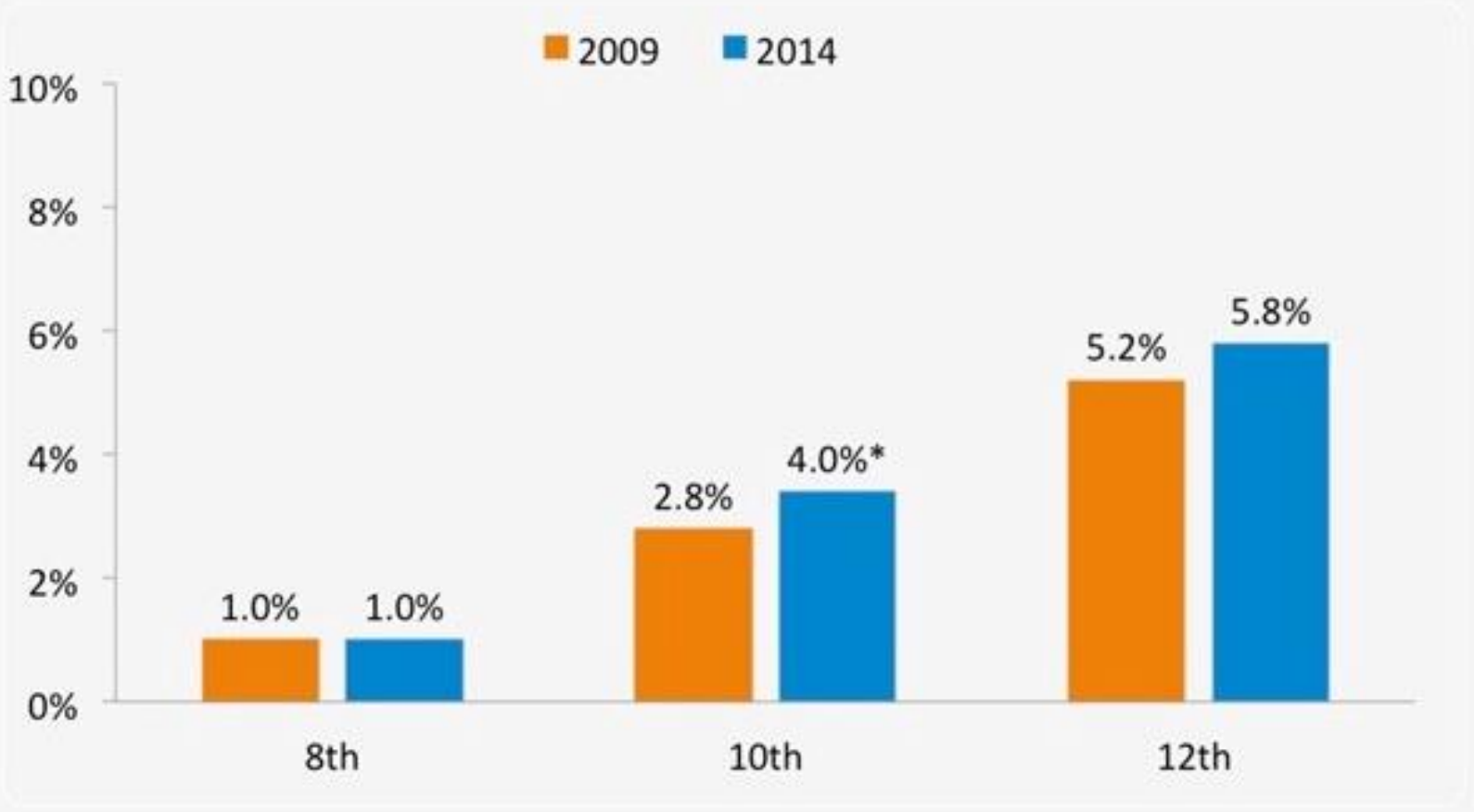
Past Month Use of Cigarettes and Marijuana among 12th graders, 1975-2014



Significant * increase or ^ decrease from 2009

Source: University of Michigan, 2014 Monitoring the Future Study

Five-Year Increase in Daily Marijuana Use among 10th and 12th Graders



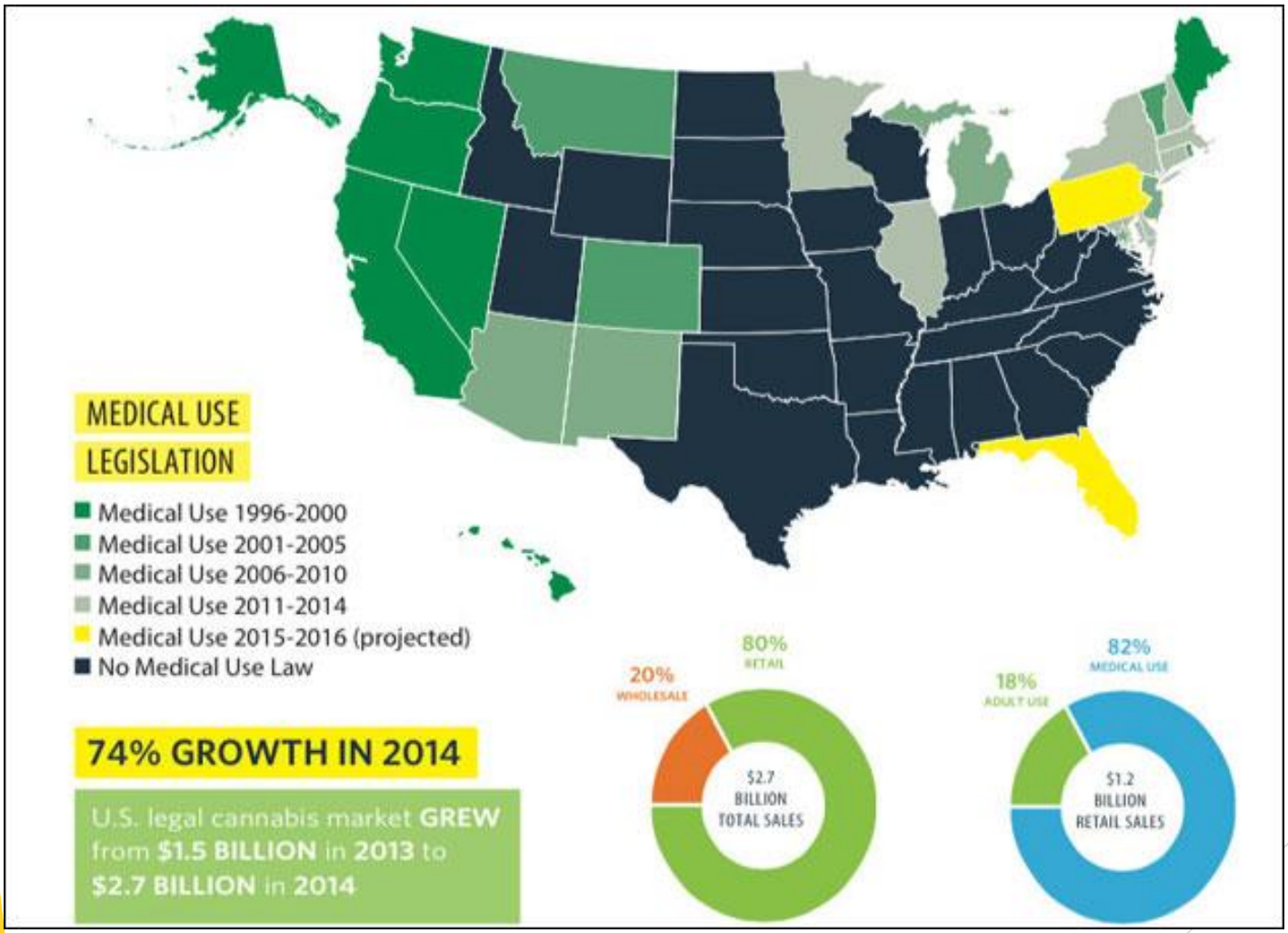
Source: University of Michigan, 2014 Monitoring the Future Study

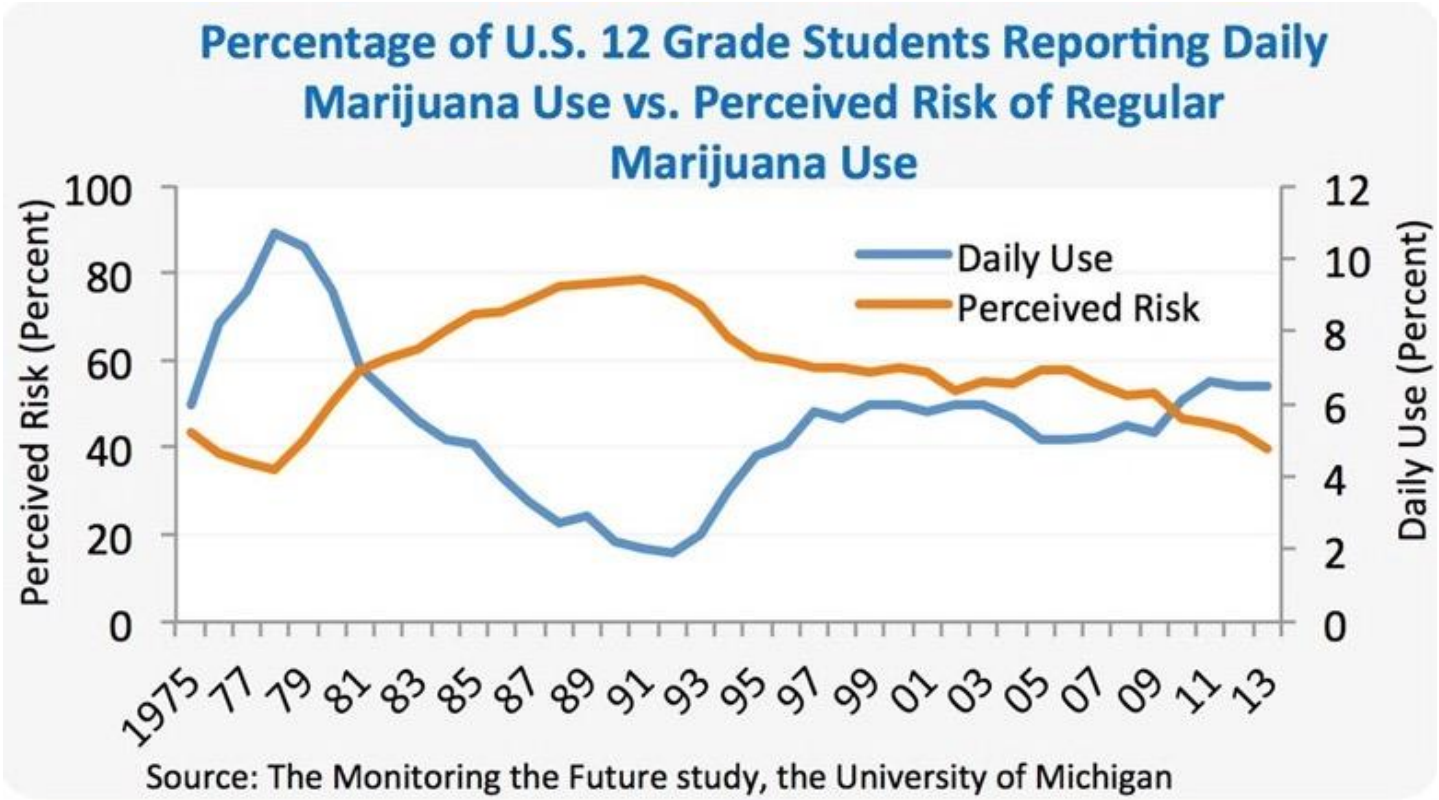
Marijuana 2014

- Increase in use of edible marijuana since change in medical marijuana laws
  - 40 percent of 12th graders who reported using marijuana in the past year said they had consumed marijuana in food products (edibles) versus 26 percent in non-medical marijuana states

23 states have Medical Marijuana Laws

Florida and Pennsylvania-Next?




Percentage of U.S. 12 Grade Students Reporting Daily Marijuana Use vs. Perceived Risk of Regular Marijuana Use
Perceived Risk (Percent)
Daily Use (Percent)
Daily Use
Perceived Risk
100
80
60
40
20
0
12
10
8
6
4
2
0
1975
77
79
81
83
85
87
89
91
93
95
97
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03
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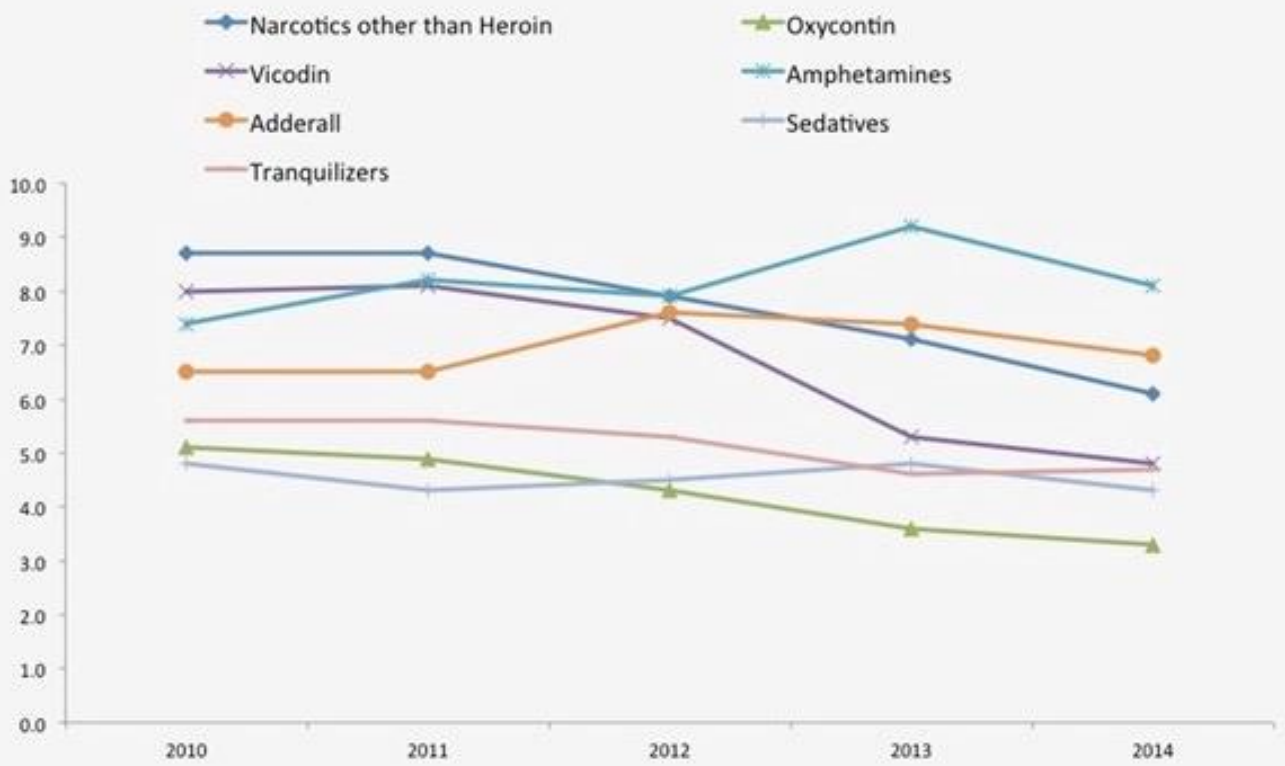
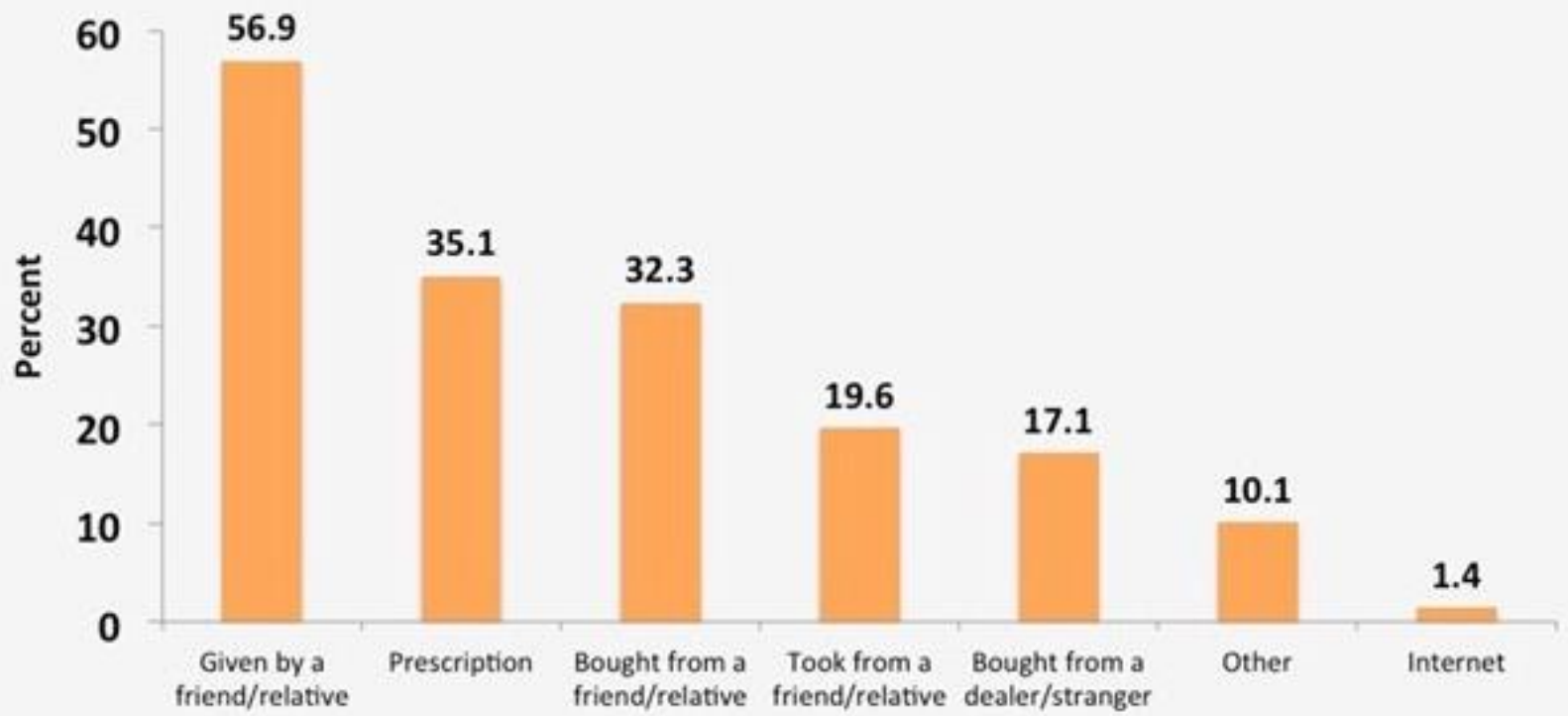
13
Source: The Monitoring the Future study, the University of Michigan

Past 5-Year Use of Prescription Drugs among 12th Graders



Source: University of Michigan, 2014 Monitoring the Future Study

Source of Prescription Narcotics among Past Year Non-medical Users, 12 Grade



§ Categories are not mutually exclusive

Source: University of Michigan, 2014 Monitoring the Future Study

Stimulants-

data from 2014 University of Michigan

Past year non-medical use of the stimulant Adderall remained relatively steady at 6.8 percent for high school seniors.

Other Drugs

Data from 2014 University of Michigan

- Illicit drugs - has generally declined in past two decades
- Inhalants - decreased use over the last five years down to 5.3% for 8th graders
- K2/Spice - considerable decline
- Bath Salts - last year use remained low (0.5% vs 1 % 8th graders)
- Inhalants - use is lowest in history of survey (5.2 % 8th graders)

Alcohol

Data from 2014 University of Michigan

- Alcohol use continues its gradual decline in all grades
  - 8th, 10th and 12th graders reported past month use of 9.0, 23.5 and 37.4 percent respectively, compared to 10.2, 25.7, and 39.2 percent last year
- There was a significant drop in binge drinking
  - (five or more drinks in a row in the last two weeks) in 2014 among high school seniors, which is now under 20 percent

FLAKKA

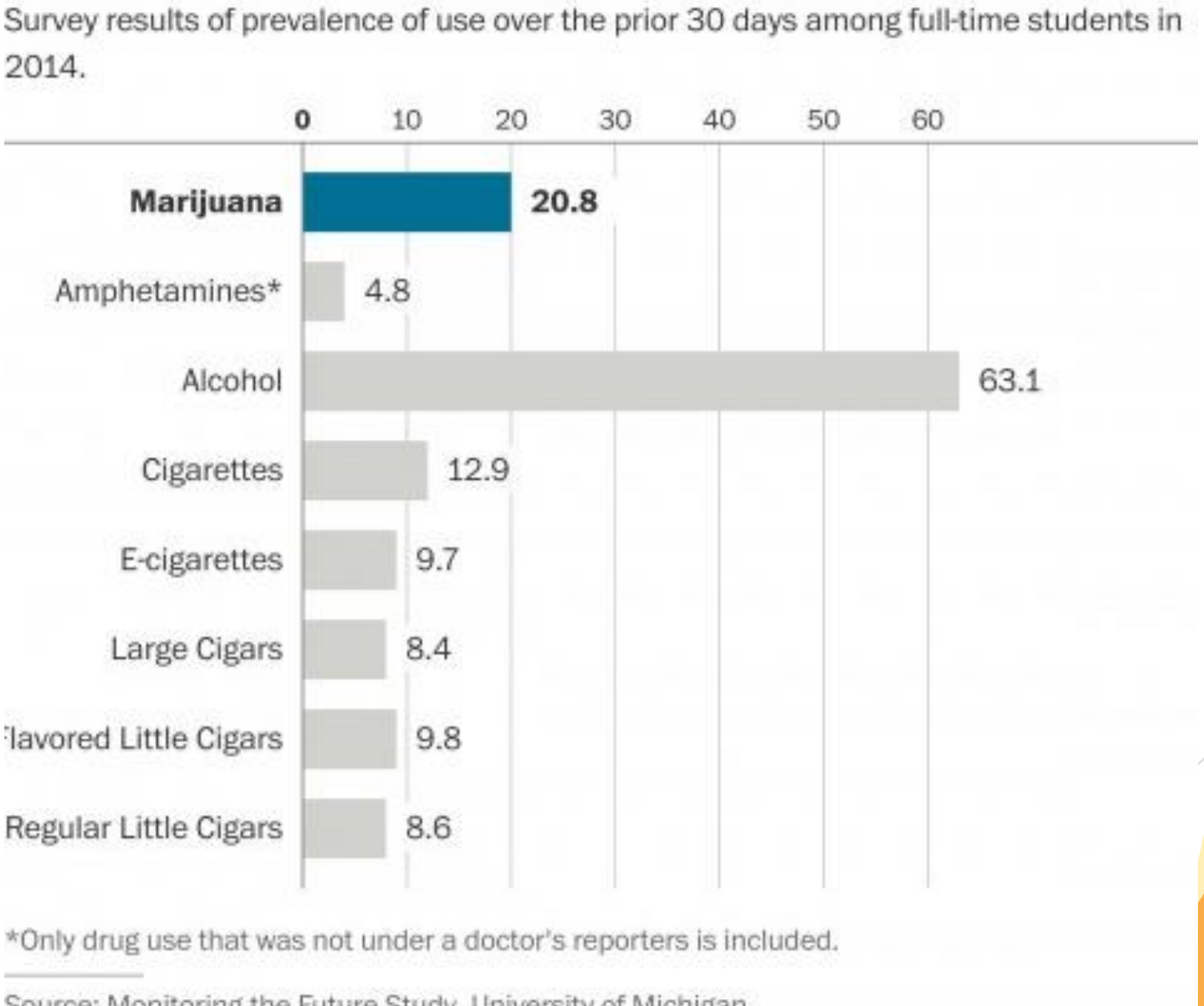
- A chemical cousin of cathinone (AKA Bath salts, or synthetic version of cathinone)
- It's designed to be a stimulant - enhancing emotions, physical feelings and awareness - however little is known about how the drug affects the brain.
- Manufactured in India and China
- Bought over the internet
- Cost $5

Flakka

- According to Journal of Analytical Toxicology, these effects occur within 30 to 40 minutes after consumption and can be likened to the behavior caused by cocaine, PCP, LSD and methamphetamine.
- It can be smoked, injected, swallowed, and snorted - purchased in a range of different mediums from crystals to pills.
- Flakka can induce seizures, paranoia, and delusions, and cause people to act with bizarre, even psychotic-like, aggressive behavior that can lead to (and, for some people, has led to) injury or death.
- In fact, people using flakka have sometimes been described as behaving like "zombies."

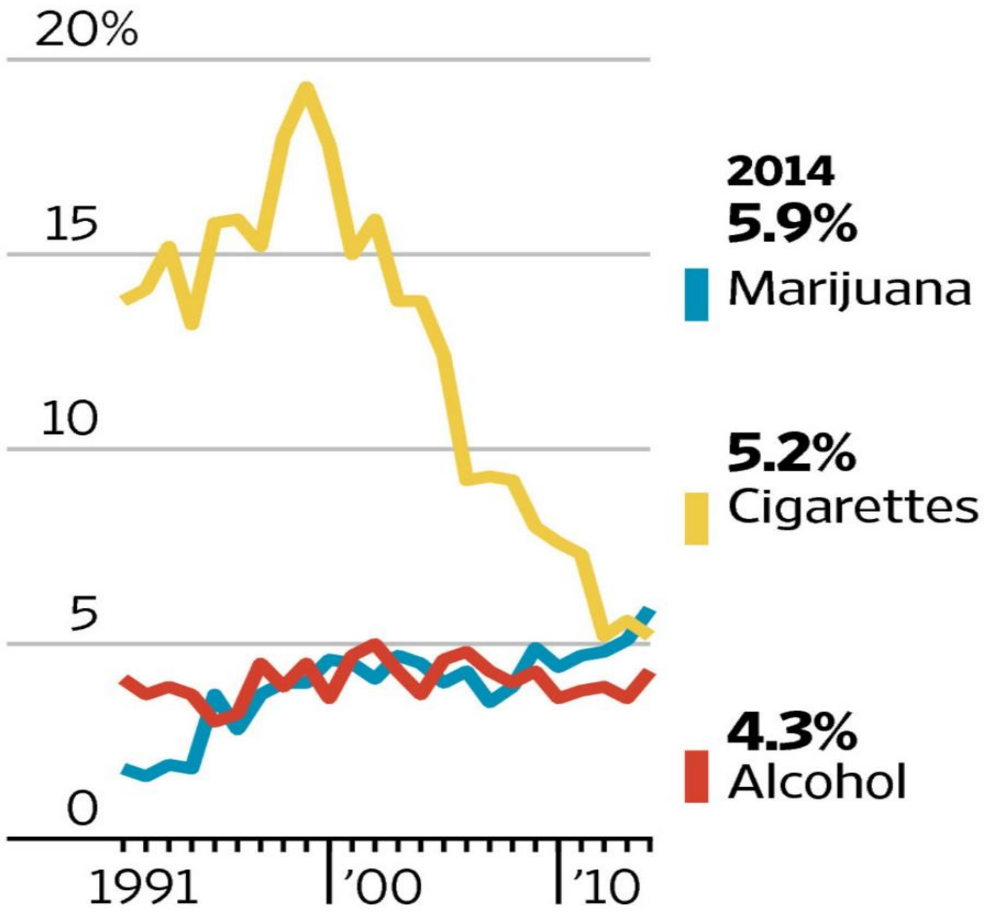
Drug Use Among College Students

Data from 2014 University of Michigan



Shifting Habits

Daily use of various substances among college students



Source: University of Michigan's Monitoring the Future study

9 out of 10 primary care doctors fail to diagnose substance abuse in patients who display classic symptoms of the disease and 4 out of 10 miss the diagnosis in teens (Califano et al, 2003)

Don’t have data for 2016—but its probably the same

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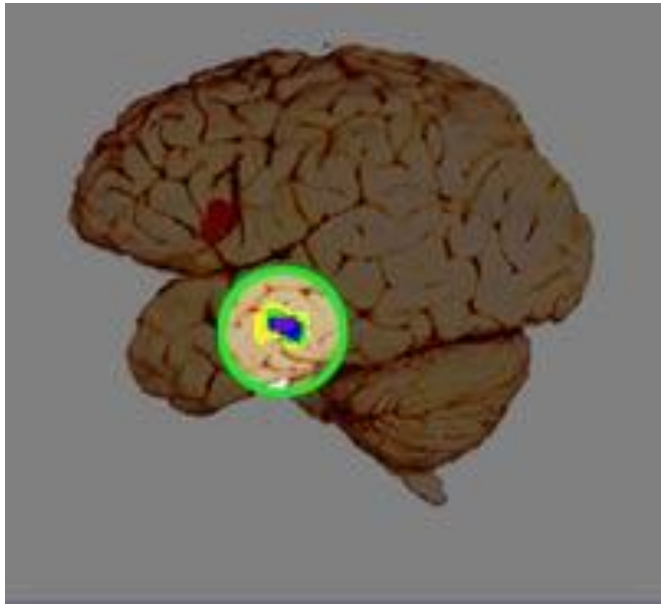
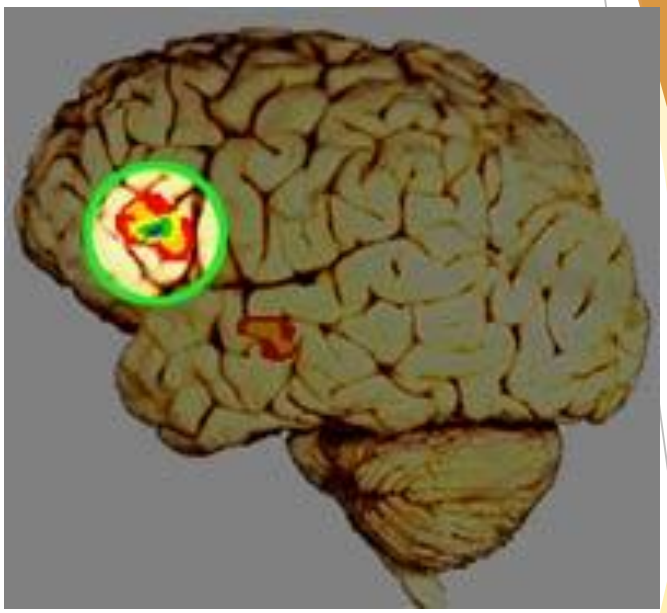
Adolescent Brain



Reward-Reward-Reward
I WANT!! I NEED!! NOW!!

Adult Brain



Judgement--Brakes—
Think before act

The Pre Frontal Cortex Disease

Adolescent dilemma:

> " . . . want to be adults and they're exposed to a semi-adult culture, but they don't have the prefrontal cortex to regulate those adult behaviors . . . . They can't apply emotional brakes."
>
> "They have the passion and the strength but no brakes and they may not get good brakes until they are twenty-five." (Giedd)

PreFrontal Cortex

Parents', therapists' and our task:

"Sometimes need to act as though they are their teenagers' "frontal cortex . . . talking through possibilities and options.

They have to function like a surrogate set of frontal lobes, an auxiliary problem solver."

Are adolescents more susceptible to alcohol than adults?

Most certainly YES

1. Reduced sensitivity to intoxication
2. Increased sensitivity to social disinhibitions
3. Greater adverse effects to cognitive functioning

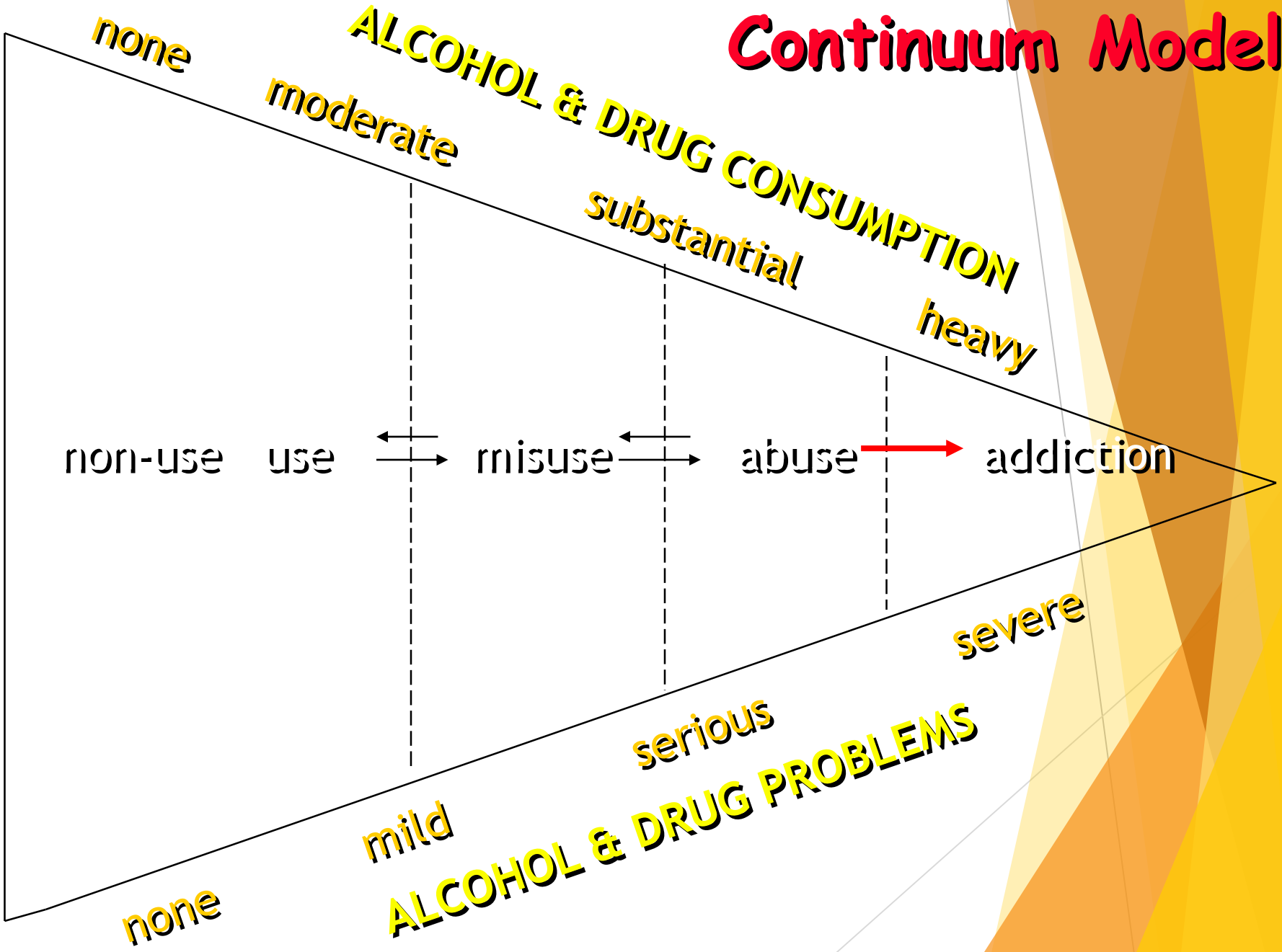
What's the big deal about kids drinking anyways???

- Have you ever seen a group of drunk teenagers?
- Demeaning behaviors
- Risk taking behaviors
- Accidents
- Teenage brain effects before 18 yrs old

Alcohol and Teenagers:

- Date Rape – one to two-thirds of teen sexual assaults involve alcohol
- 18% of Females/ 39% Males say it is acceptable for a boy to force sex if the girl is stoned or drunk
- 40% of children who start drinking before age 15 will become alcoholics
- In television 9 out of 10 drinkers are portrayed as having no effects or only positive outcomes from their alcohol consumption

Continuum Model



Pruning of the Brain

- "**USE IT OR LOSE IT**"- Reading, sports, music, video games, x-box, hanging out—whatever a child/teen is doing—these are the neural synapses that will be retained

- How children/teens spend their time is **CRUCIAL** to brain development since their activities guide the structure of the brain

Inheritance - Genes

- No single gene results in drug addiction
- Many genes may influence desirability of a drug, pleasure derived from a drug, impulsivity and restraint, taste, smell.
- Different levels of neurotransmitters like dopamine and/or type and amount of dopamine receptors in various areas of the brain might influence drug usage

40-50%

Developmental Issues and Epigenetics

exposure to drugs in utero increases the addiction risk in adolescence and adulthood

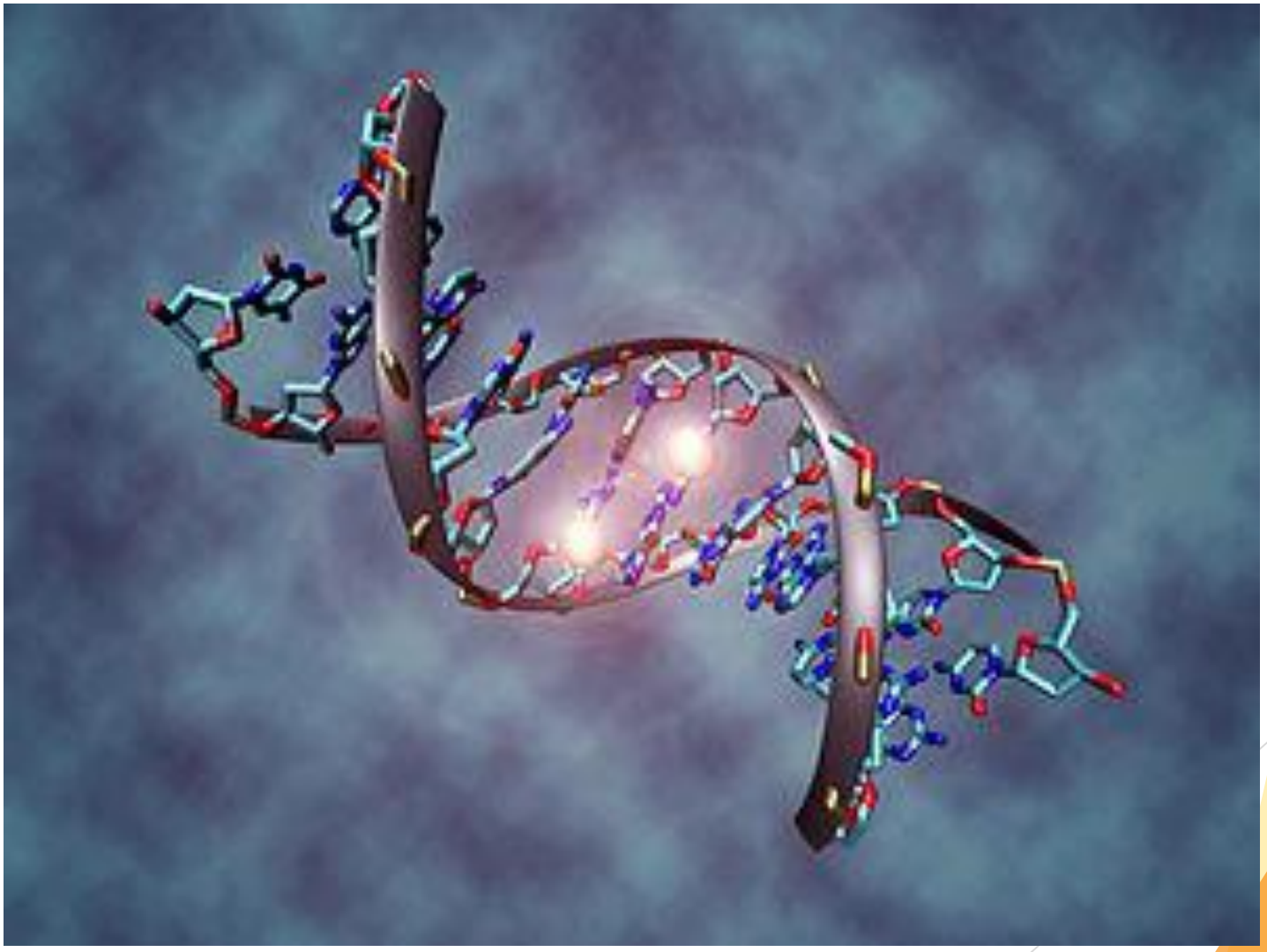
trauma & stress increases the risk of addiction

changes in gene expression may be inherited!

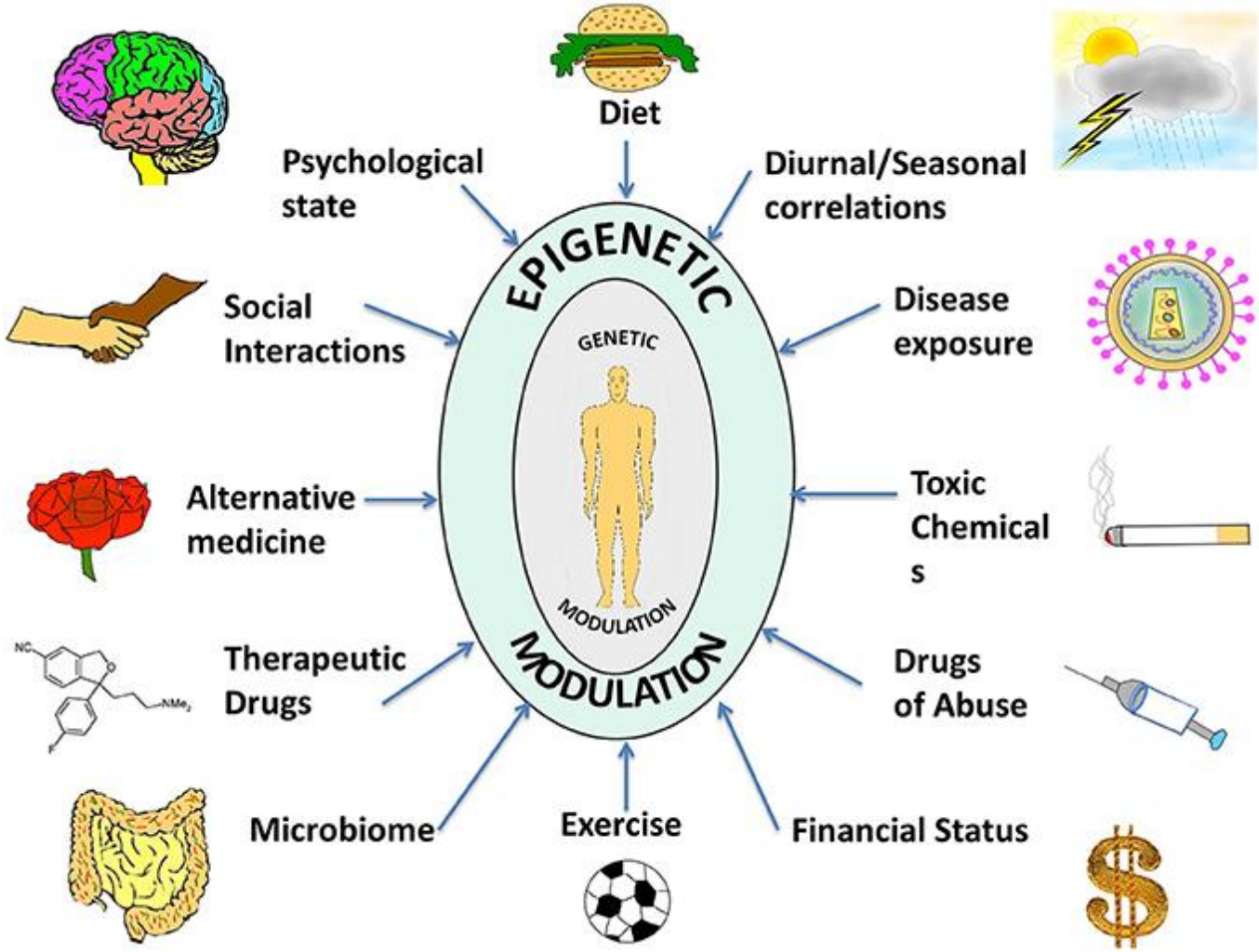
Prenatal Drug Exposure

- Unknown if drug exposure from mother causes SUD
- But, does increase risk of learning disabilities and other co-morbid issues which can increase risk of SUD

Epigenetics Methylation



Epigenetic Modulation



Personality

- Children's personality traits or temperament can place them at increased risk for later drug abuse.
  - Withdrawn and aggressive boys
  - academic failure
  - early peer rejection
  - affiliation with deviant peers

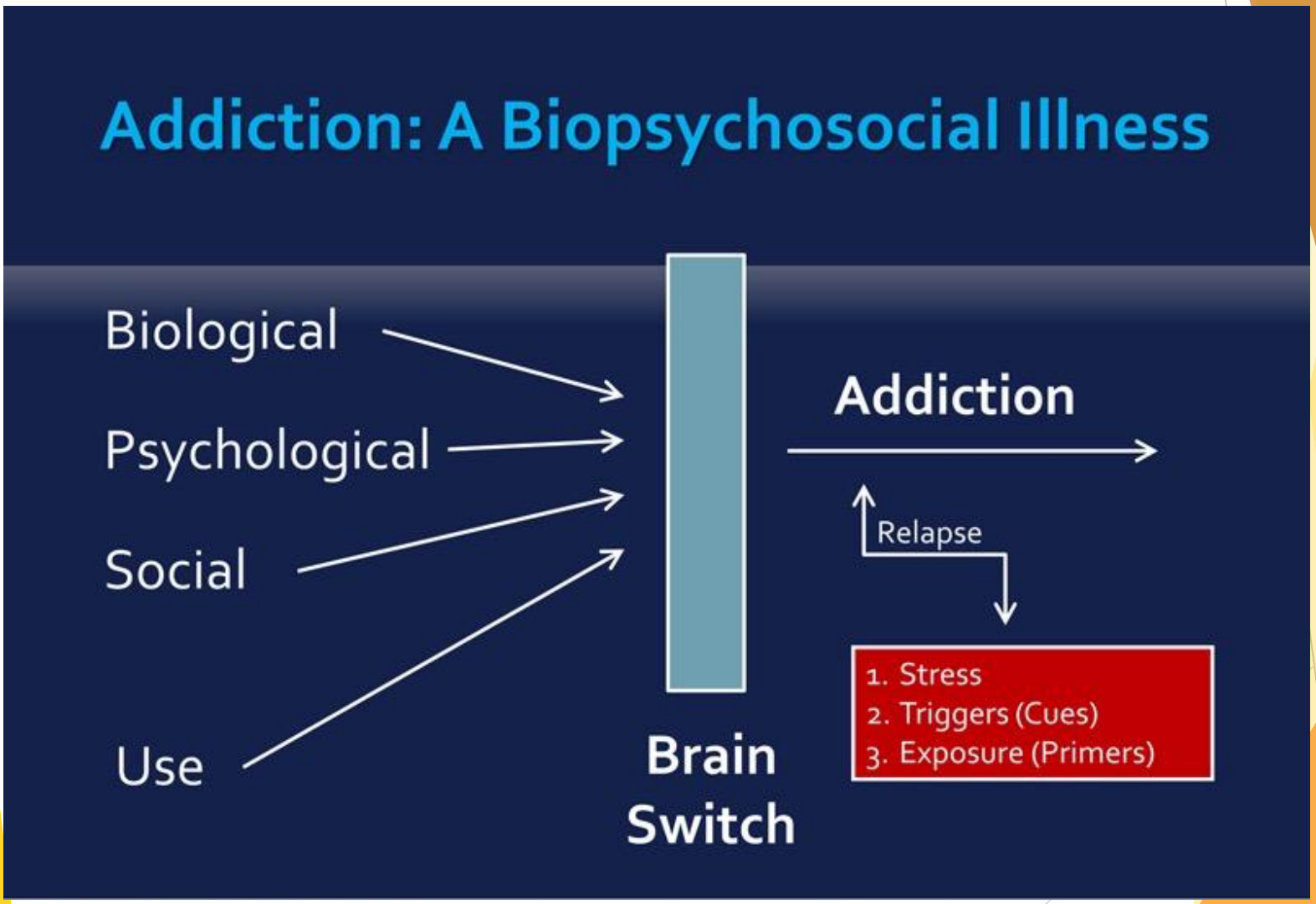
Family Risk Factors

- lack of mutual attachment and nurturing
- ineffective parenting, boundaries
- a chaotic home environment
- lack a significant relationship with a caring adult
- caregiver who abuses substances, suffers from mental illness, or engages in criminal behavior

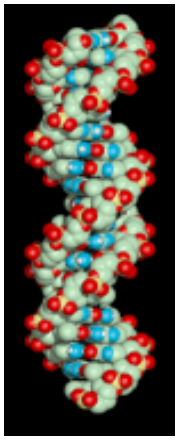
Crucial Risk Periods—TRANSITION

- Major transitions in children's lives such as physical and social
  - leave the security of the family and enter school
  - new academic and social situations, such as learning to get along with a wider group of peers and having greater expectations for academic performance
- Entering high school, college

Addiction: A Biopsychosocial Illness



Genetics/ Epigenetics

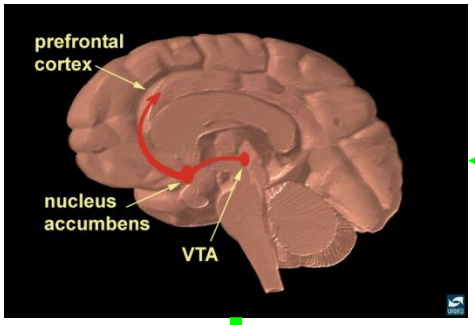


Abnormal genes or
newly expressed

abnormal proteins

enzymes
receptors
responses

malfunction MFB



impaired control

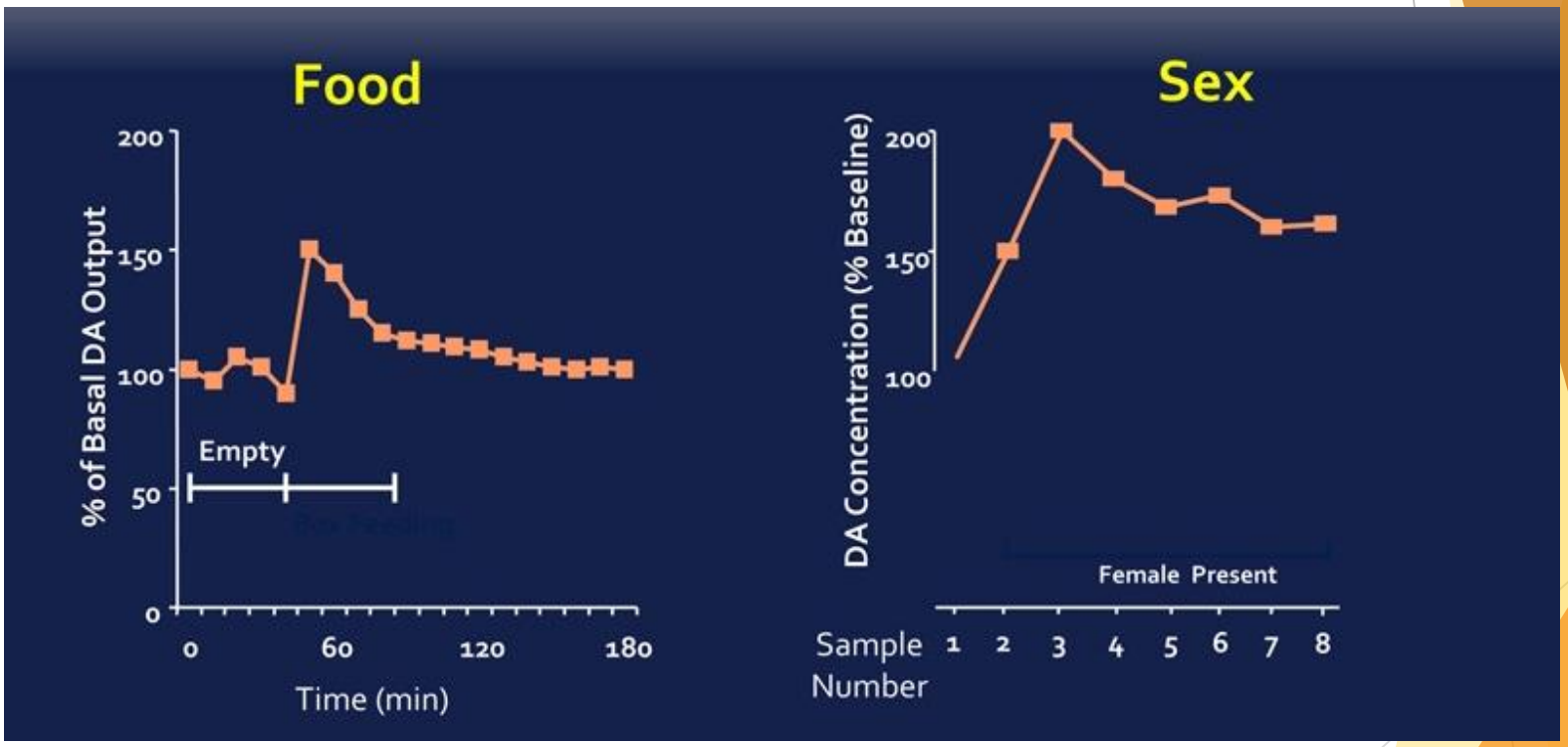
Prolonged drug use changes the brain in fundamental and long-lasting ways

And evidence shows that these changes are both functional and structural.

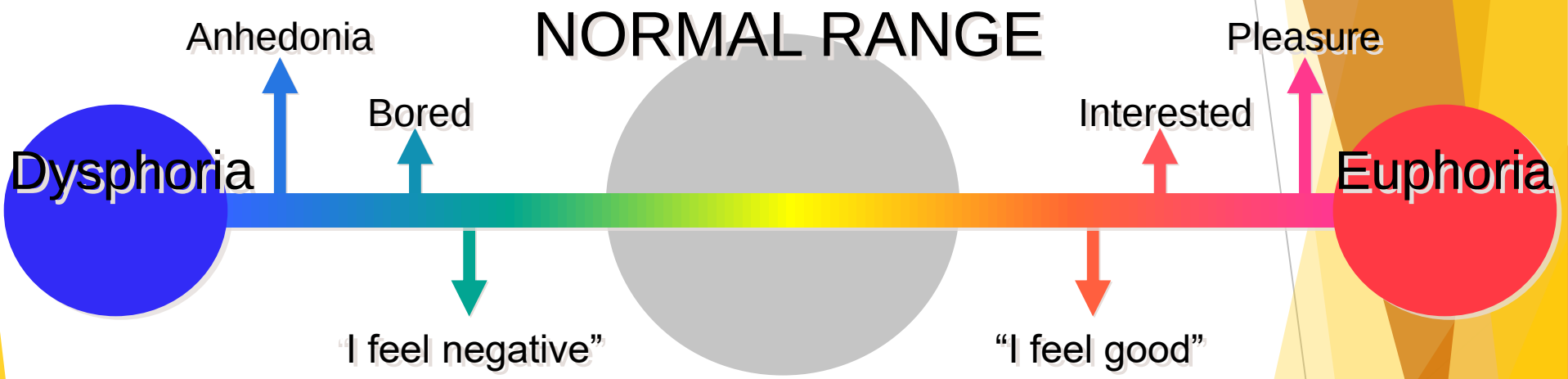
Long-term drug exposure impairs brain functioning

1. Release **2 to 10 times** more dopamine than natural rewards (eating, sex and social activities)
2. **Powerful reward** strongly motivates people to take drugs again and again.
3. The brain **adjusts** - producing less dopamine and reducing the number of receptors that can receive signals
4. The ability to experience ***ANY*** pleasure is **reduced**.

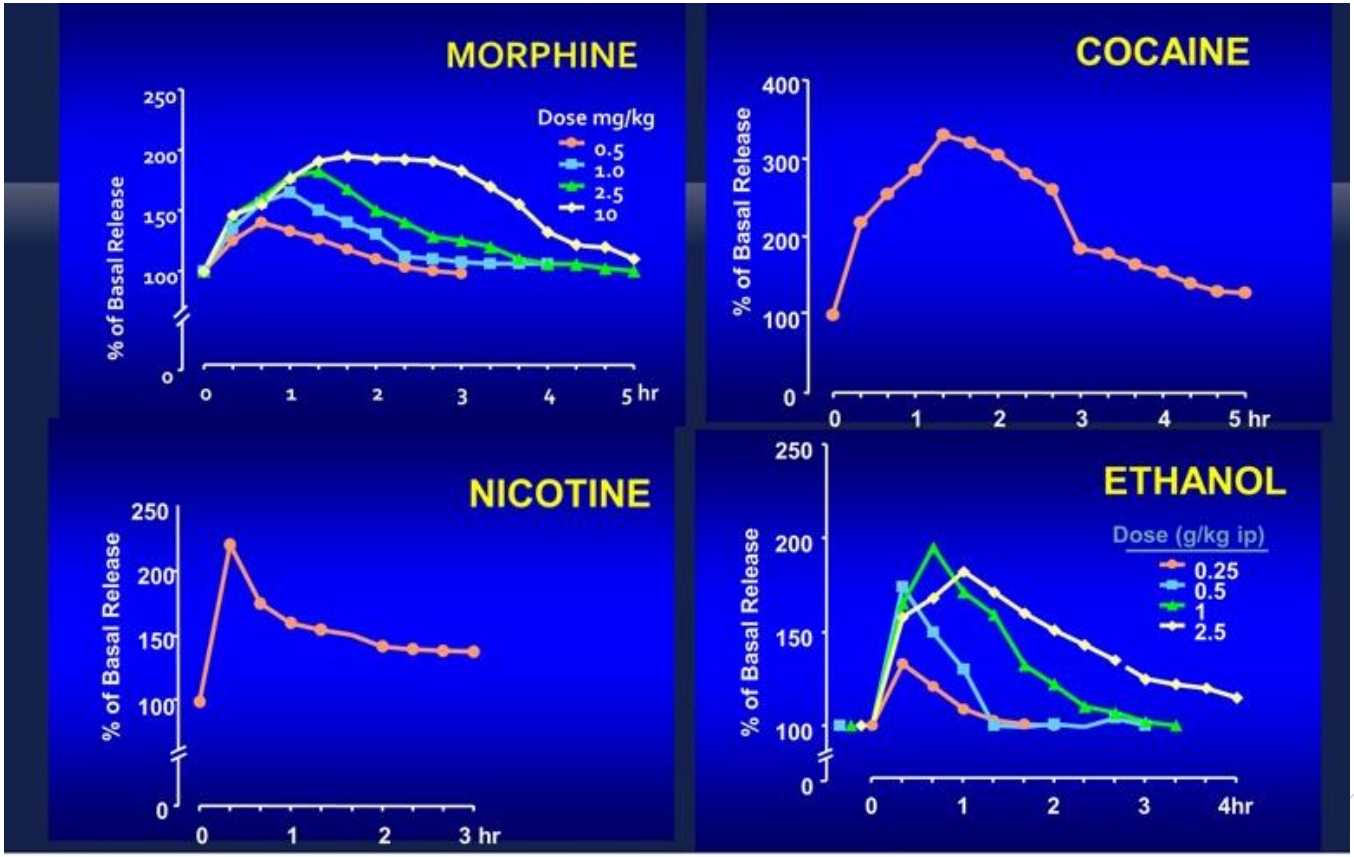
Natural Rewards and Dopamine Levels



Adapted from: DiChiara et at, *Neuroscience*, 1999
Adapted from Fiorino and Phillips, *J Neuroscience*, 1997

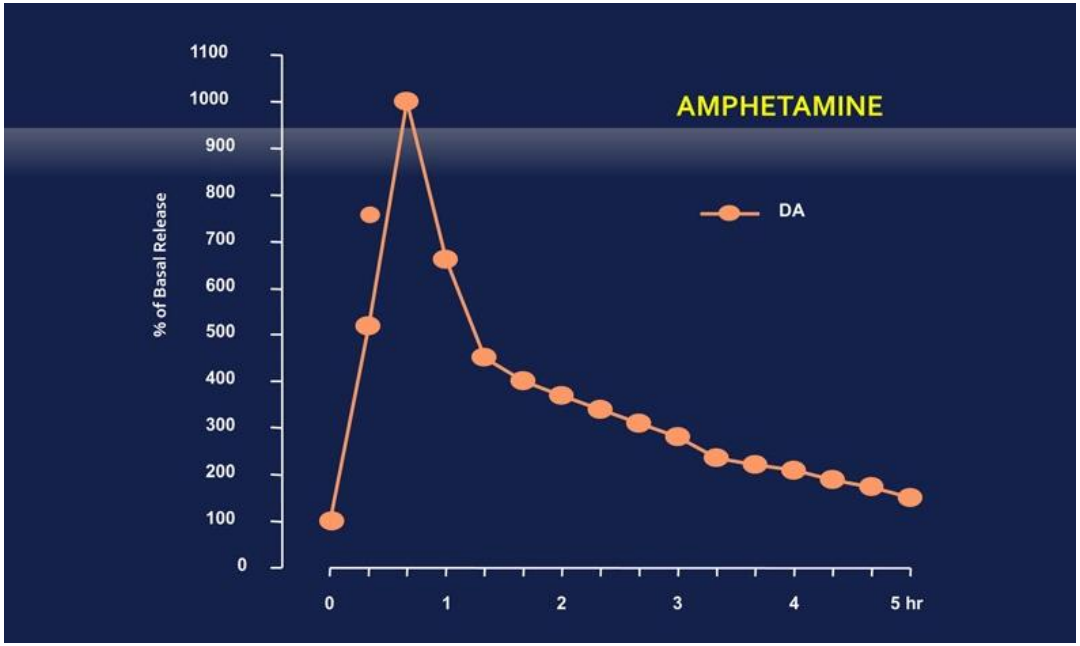

NORMAL RANGE
Anhedonia
Pleasure
Bored
Interested
Dysphoria
Euphoria
I feel negative”
“I feel good”

Effects of Drugs on Dopamine Levels



Adapted from: DiChiara and Imperato, Proceedings of the National Academy of Sciences USA, 1988, courtesy of NoraD Volkow, MD

Effects of Amphetamines on Dopamine Levels



Adapted from: DiChiara and Imperato, Proceedings of the National Academy of Sciences USA, 1988, courtesy of NoraD Volkow, MD

Dopamine vs. Serotonin
Pleasure vs. Happiness

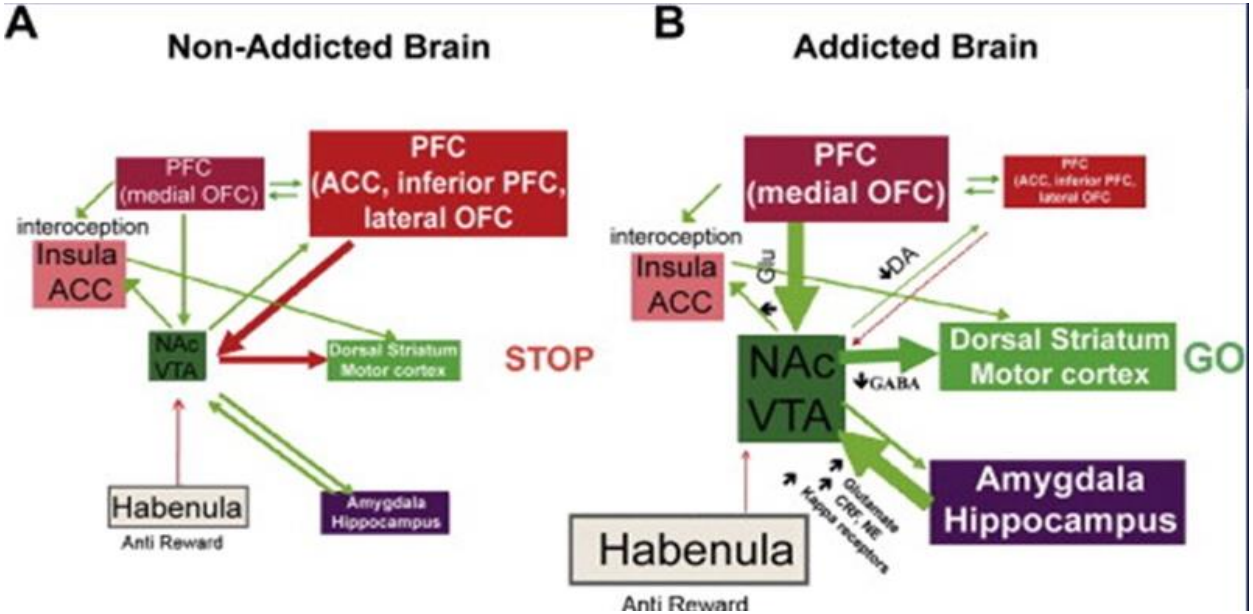
- Dopamine produces a feeling of pleasure
- Serotonin produces a feeling of well being
- Difference between pleasure and happiness (short lived vs big picture)
- Developing skills, interest, relationships, meaning (“getting a life”)

Age of Onset & Risk

- alcohol use begin:
  - 11-12 -> 13.5% abuse, 15.9% dependence
  - 19-20 -> 2% abuse, 1% dependence
- alcohol use before 15 compared to begin after 21, "4" times more likely to be alcoholic.
- earlier drinking starts, the more rapid the progression of the disease

The Stop-Go Model

Volkow, ND and baler, RD, Neuropharmacology, 2013



1. Addiction hijacks the pleasure/reward pathways (VTA, NA) of the brain.
2. Hippocampus (memory), amygdala (emotions), and lateral OFC (executive control) add to our neurobiological understanding of the illness.
3. Medial OFC (motivation), habenula (anti-reward systems), and insula (interoception) complete the STOP-GO model of addiction.

Concerns

- Changing attitudes about harm associated with marijuana use – "Medical Marijuana laws"
- Marijuana use greater than cigarette use
- Use of e-cigarettes, measured in the report for the first time, is high

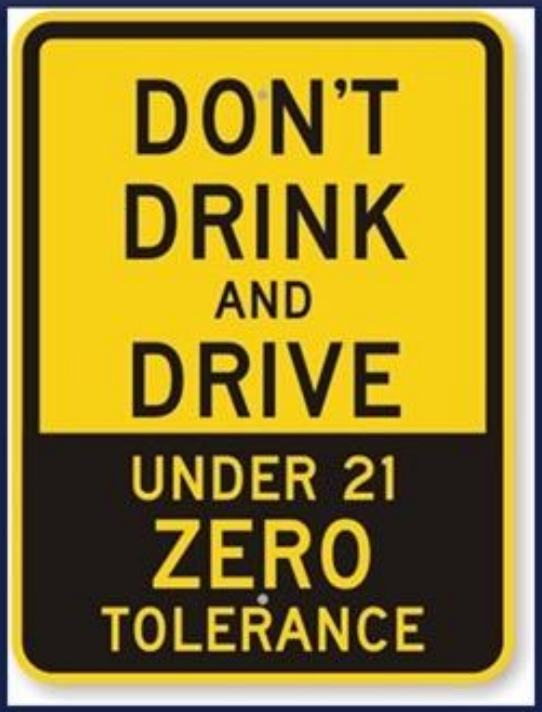
Why screen?

- 1 in 3 children starts drinking by the end of 8th grade … and of them, half report having been drunk.
- 50% high school students have used illicit drugs in their lifetime
- Drinking is associated with three top causes of death among adolescents, the first being unintentional injury, usually by car crashes, followed by homicide and suicide (CDC, 2008).
- It's a marker for other unhealthy behavior

SCREENING-SCREENING-SCREENING

- Begin age 9
- Interview without parents (at some point)
- Consider dangers of maintaining confidentiality when risk behaviors exist
- Comprehensive measures/screens are available

Acute Danger Symptoms



- Drinking & driving
- Unless a patient who drinks and drives commits to stopping, an immediate intervention is warranted

More Acute Danger Findings

- High, potentially lethal volume intake
- Combining alcohol with other drugs, especially sedatives
- Substance-related hospital visits or injuries; alcohol poisoning
- Unplanned or unprotected sexual activity associated with alcohol use
- Signs of alcohol addiction; drinking daily or near-daily; having memory blackouts
- Use of intravenous drugs

Two Powerful Questions

- **Friends: Any drinking?**
  - "Do you have any friends
  - who drank beer, wine, or any drink containing alcohol in the ***past year***?"
  - **ANY drinking by friends heightens concern.**
- **Patient: Any drinking?**
  - "How about you—have you ***ever*** had more than a few sips of beer, wine, or any drink containing alcohol?"
  - Number of drinking days per year more significant than amount
  - **ANY drinking: highest risk**

CRAFFT – Adolescent Screen

C	Have you ever driven a Car when high or been in a car driven by a friend who was high?
R	Do you ever use drugs to Relax, feel better about yourself or fit in?
A	Do you ever use drugs while you are Alone?
F	Do you ever Forget things you did while using drugs?
F	Do your Family or Friends ever tell you that you should cut down on your drug use?
T	Have you ever gotten into Trouble while you were using drugs

Paper version is more reliable than interviewer.

Two or more "yes" answers suggest serious problems with substances and require further investigation. Knight et al. 1999

Drug Testing in HS???

- Supreme court decision (Earl vs Board of Education) support screening of those participating in extracurricular sports
- ONDCP/White House – supports above decision
- American Academy of Pediatrics is against school and parent screening!!!
  - Hurts parent/school relationship
  - Less kids will participate in sports?
  - Defer to Pediatrician's expertise

Prevention Factors

- Supportive family (tuned in, time together, supervision, fair rules/boundaries)
- Non using peers and role models – are we interested in really changing the culture?
- Youth are connected (school, activities)
- Social Skills (e.g. dancing)
- Resiliency (coping with stress, celebration)

Family Protective Factors

- strong bond between children and their families (often develop in infancy)
- parental involvement in a child's life
- supportive parenting that meets financial, emotional, cognitive, and social needs
- clear limits and consistent enforcement of discipline

Family Prevention Programs

- With or without the adolescent
- Best Parenting programs
  - Focus on family bonding & communicating
  - Enhance parenting skills - family monitoring, supervision and rule setting, policies on use
  - Improve self-regulation skills
  - Address social skills – sober friends
- Variable results but more than half worked
- Long-term effectiveness unclear
- Problem: families at greatest risk don't attend

What to do

- Get out of the using environment.
- Find alternative sources of pleasure.
- Work on balancing stress.
- Seek help for mental health issues and other personal stresses.

Tobacco Prevention - School

- Variable findings
- Cochrane – best were social resistance with cognitive or affective strategies
- Knowledge based limited value mostly in short term
- Behavioral strategies longer lasting benefits
- Best were programs with continued application and or "booster" strategies

What Works

- Twelve Step Models
- Motivational Enhancement Therapy (MET)
- Motivational Incentives (Contingency Management)
- Certain Family Therapies
- Matrix Model (Stimulants)
- Seeking Safety Model (Women and Trauma)
- Relapse Prevention (Marlatt)
- Cognitive Behavioral Therapy

Reaching Teenagers

- Don’t shove this kind of information down their throat
- No propaganda
- Non-judgmental/ Fair and Balanced
- Honest with integrity
- Interactive
- Honoring where they are and what they know
- Let them steal the information
- Authenticity

What Does Not Work!

- Confrontation (The goal of the first session is to have a second session)
- Substance abuse education alone
- Group therapy and residential treatment with some adolescent populations

Peer Factors & Treatment

PEER-RELATED FACTORS: Strongest predictor of adolescent substance *use*

- Positive Peer culture – effective treatment modality

12-STEP Mutual Help Groups Adolescents

- There is not enough research but the ones so far are mostly positive
- Longer attendance = better outcome
- Adapt for adolescents
- Concepts like "powerlessness" are difficult to comprehend
- "Spiritual awakening" – associated with sobriety

At the end of the day…the message:

- Non-Use is as Normal as Experimental Use
- Use = Risk
- Risk is not Evenly Distributed
- Addiction is Real
- Quality of Life can be diminished even without developing addiction; i.e., Seduction Vs Addiction
- Motivations for Initial Vs Continuing Use are always different
- DELAY, DELAY, DELAY

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an advanced approach to patient care

Next Generation Village
An Advanced Approach to Patient Care

ONE TEAM
ONE VISION