

Nicotine and Stimulant Use in Adolescents

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Disclosures

- No financial relationships to disclose.

The contents of this activity may include discussion of off label or investigative drug uses. The faculty is aware that it is their responsibility to disclose this information.

Target Audience

- The overarching goal of PCSS-MAT is to make available the most effective medication-assisted treatments to serve patients in a variety of settings, including primary care, psychiatric care, and pain management settings.

Educational Objectives

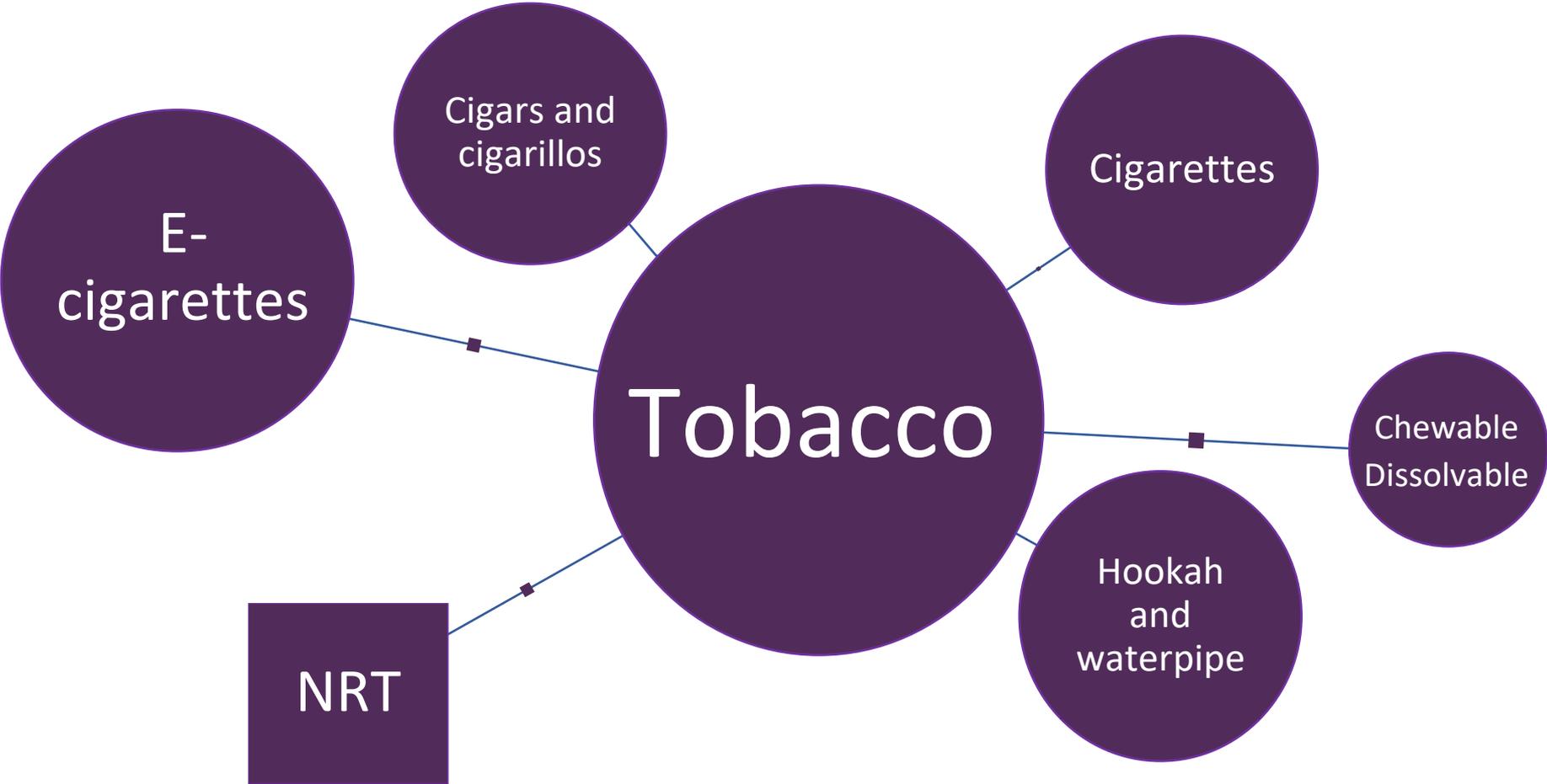
At the conclusion of this activity participants should be able to:

- Discuss recent trends in nicotine and stimulant use among adolescents
- Describe the health risks of nicotine and stimulant drugs
- Apply evidence-based treatment for youth with tobacco/nicotine use and stimulant misuse

Outline

1. Definitions and trends in nicotine products
2. Neurobiology and health impacts of nicotine use
3. Nicotine prevention and cessation in adolescents
4. Illicit stimulants: Trends, risks and treatment
5. Prescription stimulants: Trends, risks and treatment
6. Caffeine: Trends and health risks
7. Conclusion/take home points

Nicotine and Tobacco Products



Smoked Tobacco Products

Cigars and cigarillos



Kretek



Bidi



Hookah



Smoked Tobacco Products

Products	Alternate Names	Description
Cigar	Cigarillo, figurado	Large, tightly rolled bundle of tobacco wrapped in leaf tobacco
Hookah	Pipes, waterpipe, hubble, bubble, narghile, shisha	Lit tobacco bubbles through water, inhaled through shared mouthpiece
Bidi		Hand-rolled leaf-wrapped cigarette, often with flavors
Kretek	Clove cigarette	Rolled mixture of tobacco, cloves and additives

Smokeless Tobacco Products



Chewing Tobacco¹



Dissolvable tobacco²



Moist snuff



Dry snuff



Snus³

Alternate Tobacco Products: Smokeless

Products	Alternate Names	Description
Chewing tobacco	Chew, spit tobacco	Consumed by holding between gum and cheek (loose-leaf, “plug” or “rolls”)
Snuff	Pinch, dip	Finely ground tobacco (dry or moist) inhaled or held in mouth
Snus		Form of moist snuff dispensed in packets, held in mouth, no spitting
Dissolvable tobacco		3 forms: strips, sticks or pellets/orbs

E-pipes, E-cigars and E-cigarettes



Vaping products¹

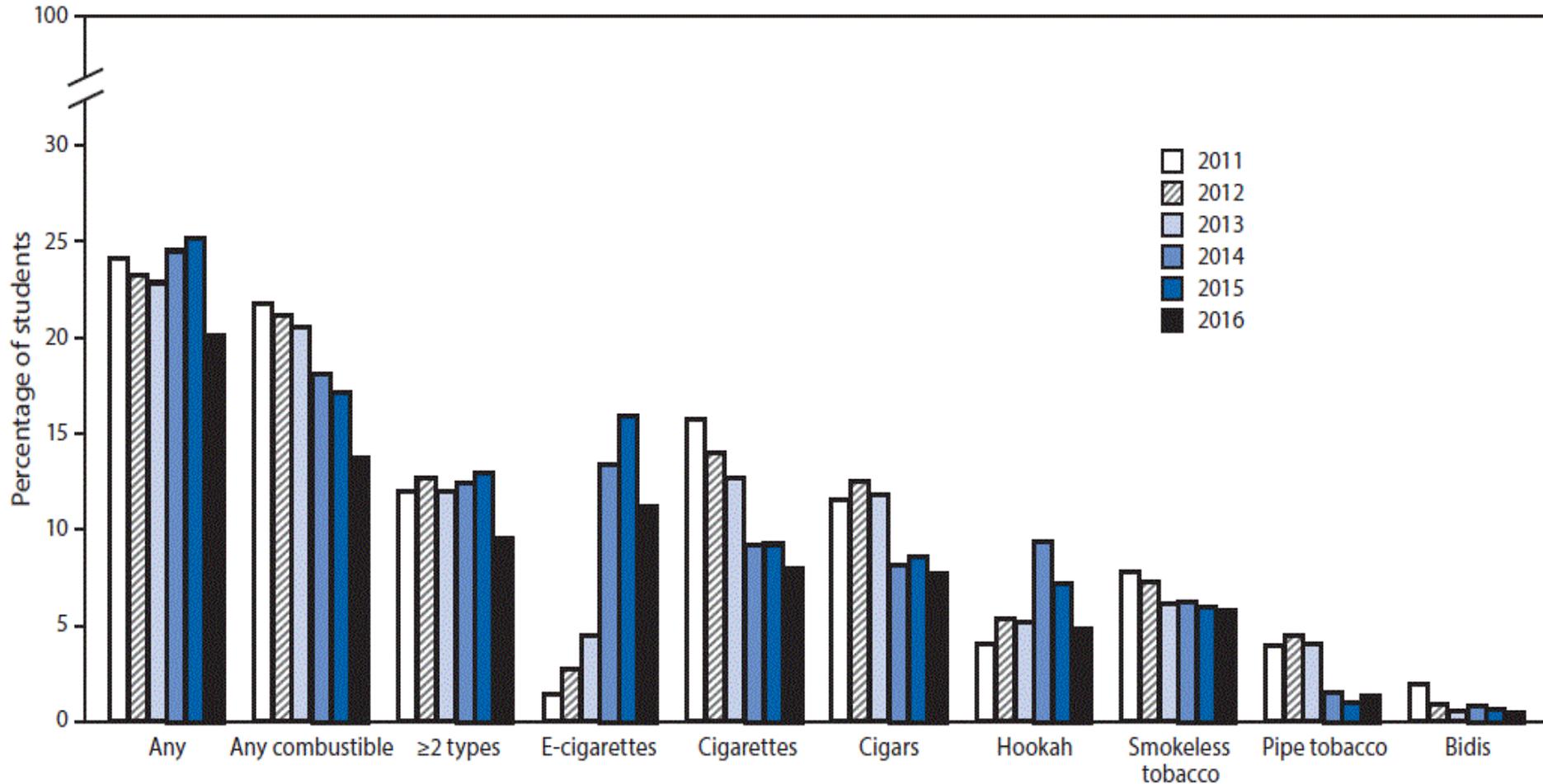


E-liquids²

Influences and Beliefs

- 2 of the **strongest factors** associated with smoking initiation in children and adolescents are:
 - **Parental smoking**
 - **Parental nicotine dependence**
- **Other factors**
 - Age
 - Low level of parental monitoring
 - Socioeconomic status
 - Peer and family influence/support
 - Misperceptions about social/health consequences

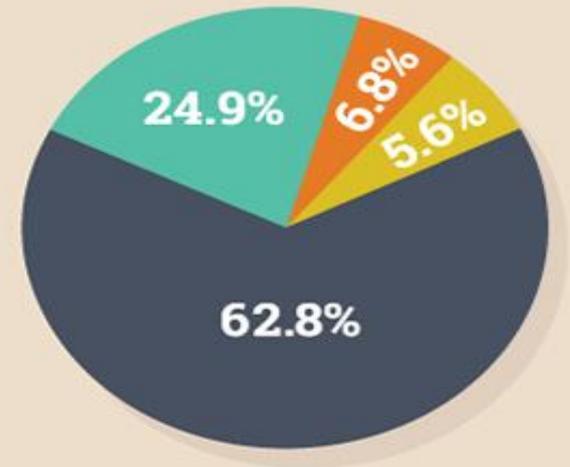
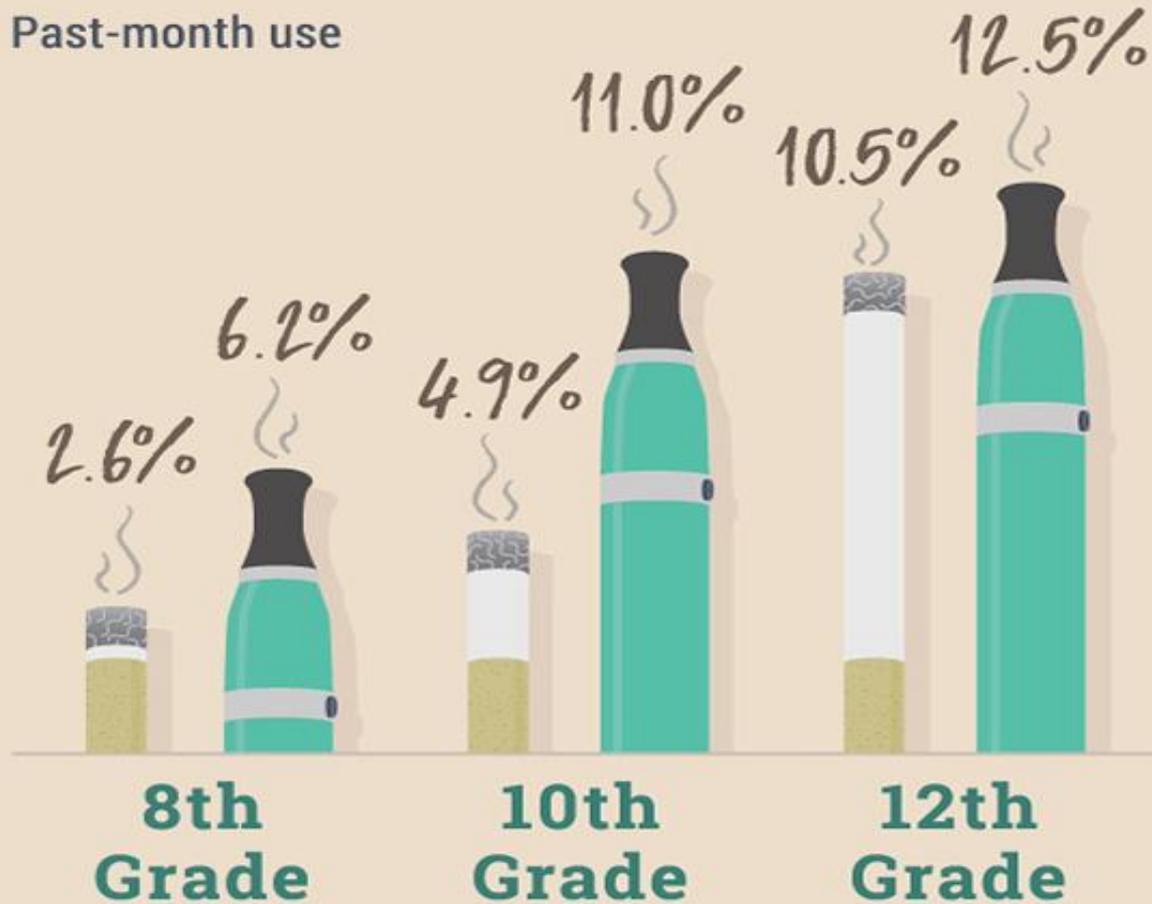
Past 30 Day Use of Tobacco Products and E-cigarettes Among Middle and High School Students (US)



Cigarettes vs E-cigarettes

TEENS MORE LIKELY TO USE E-CIGARETTES THAN CIGARETTES

Past-month use



What did 12th graders think was in the mist they inhaled from an e-cigarette? Despite the belief that the liquid used in e-cigs contains only flavoring, it also might contain nicotine.

- Flavoring
- Nicotine
- Marijuana or hash oil
- Don't know

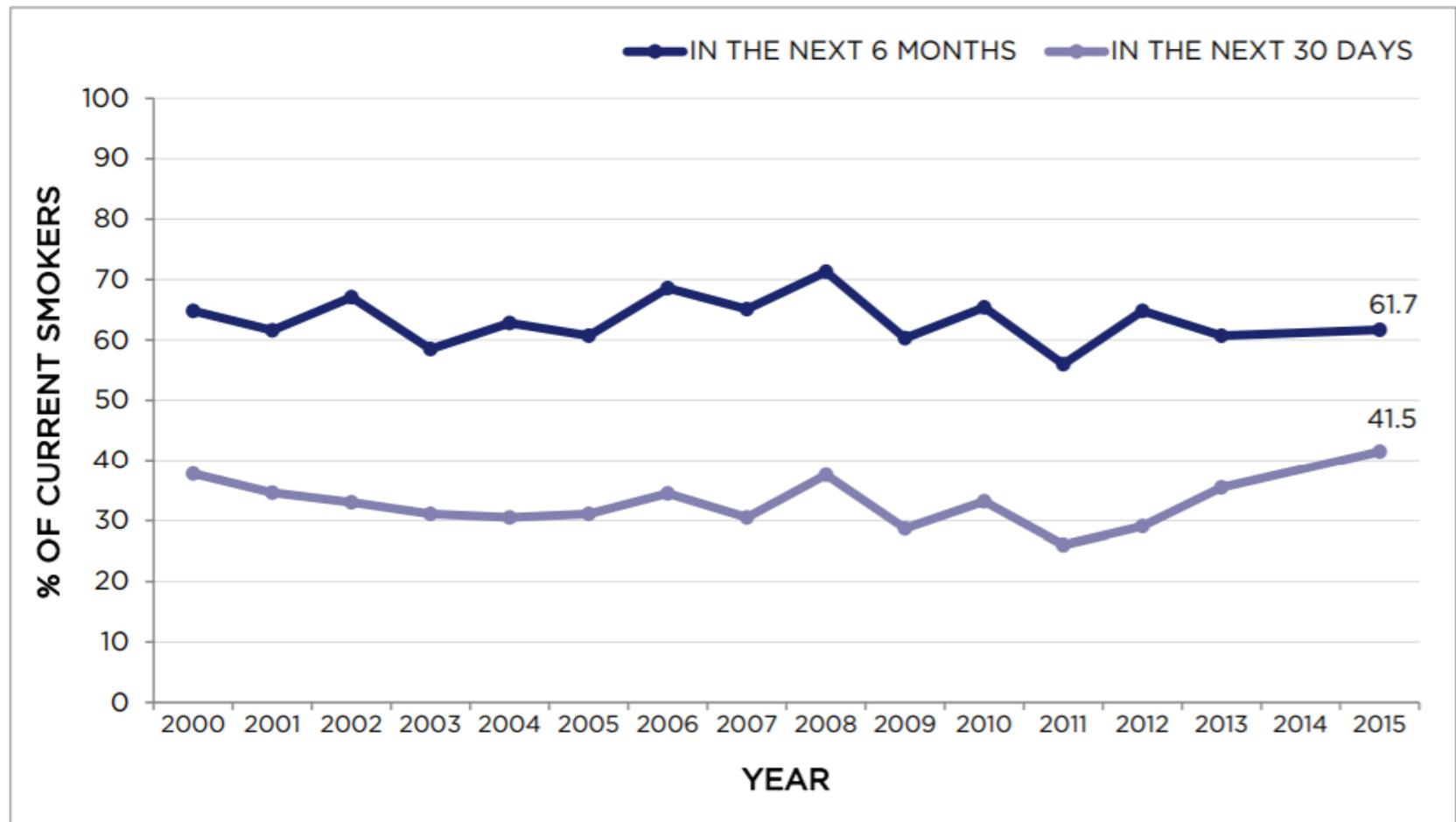
Cigarettes vs Marijuana

TEENS MORE LIKELY TO USE MARIJUANA THAN CIGARETTES

Daily use among 12th graders

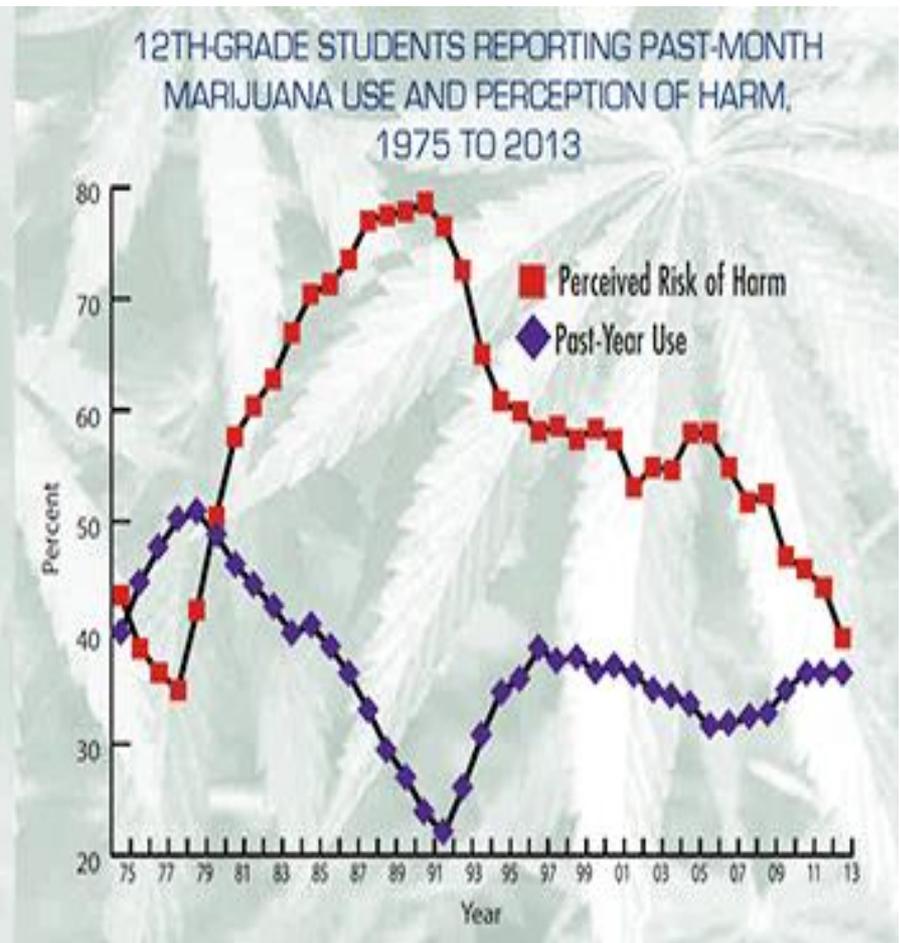
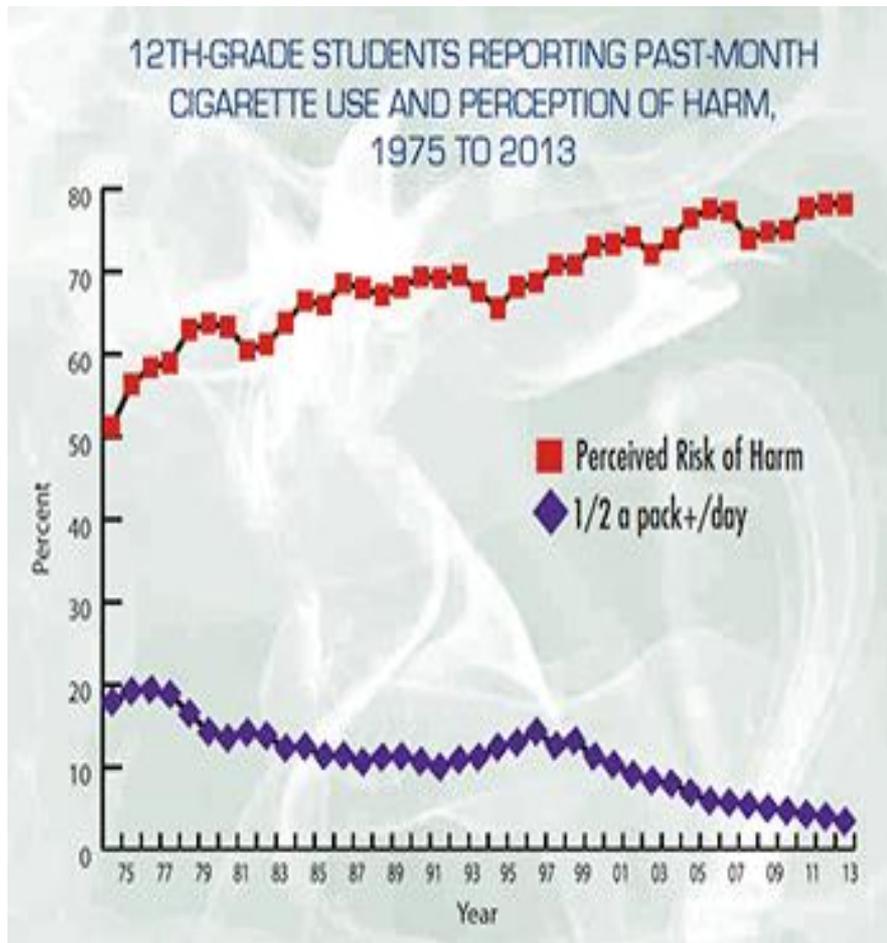


Percentage of Smokers Aged 15-19 Seriously Considering Quitting in the Next 6 months/30 days



Reid JL, Hammond D, Rynard VL, Madill CL, Burkhalter R (2017). Tobacco Use in Canada: Patterns and Trends, 2017 Edition. Waterloo, ON: Propel Centre for Population Health Impact, University of Waterloo.

Risk Perception: Tobacco vs Marijuana



Neurobiology and Health Impacts of Nicotine Use



Nicotine Addiction

- Nicotine is a **highly addictive substance**, possibly more so than cannabis, alcohol and cocaine¹
- Cravings can emerge only 3-4 months after the first cigarette/e-cigarette, sometimes less
- 18 months after the first cigarette, 25% of young smokers lose confidence in their ability to quit
- Youth: **less severe withdrawal symptoms**, but can appear after only a few cigarettes
 - Obstacle for early cessation

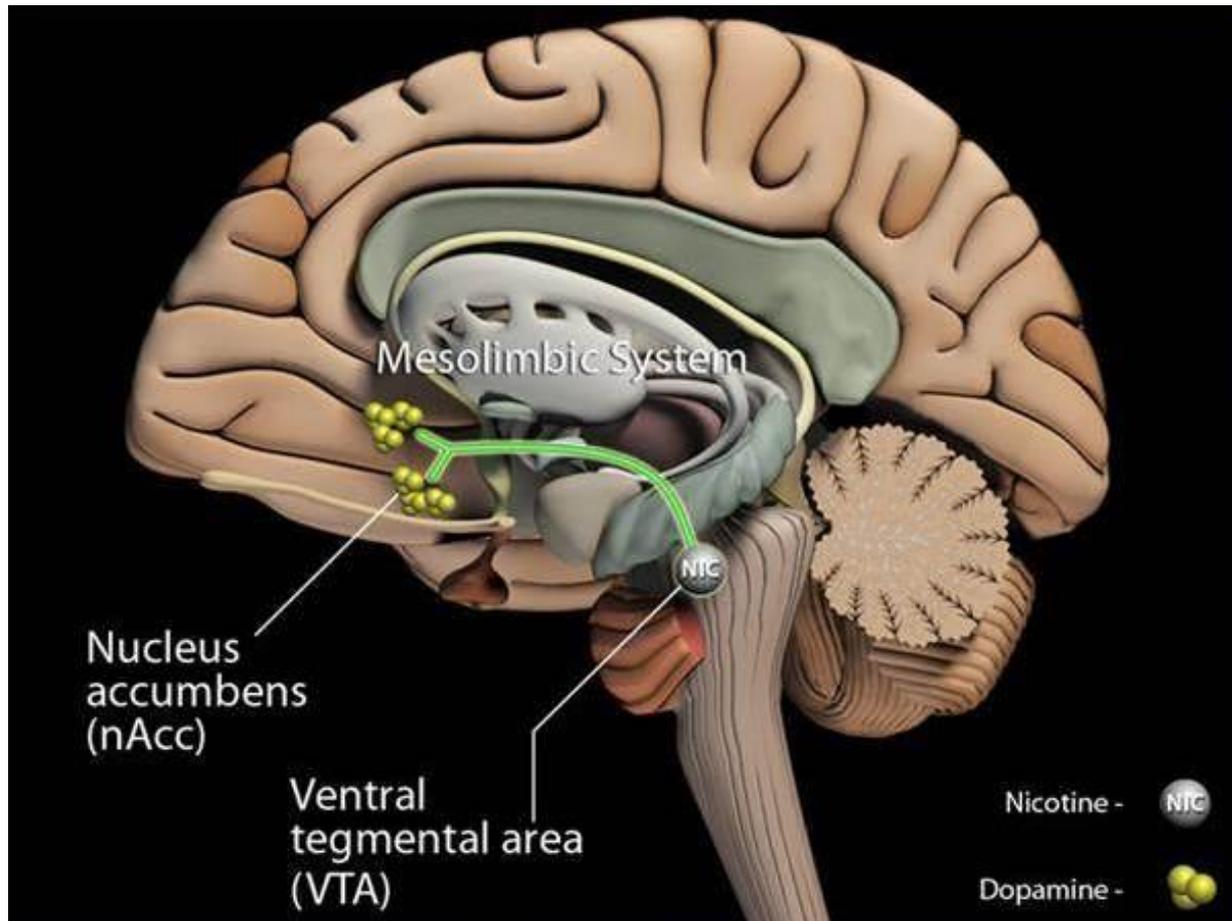
Nicotine and the Teen Brain

- **Persistent changes** in the development of neuronal connectivity (dendritic formation)
- **Specific brain areas** affected:
 - Nucleus accumbens (reward center)
 - Medial prefrontal cortex (executive functioning)
 - Amygdala (emotional regulation)

Nicotine and the Teen Brain

- Epigenetic changes: increased **sensitivity** to other drugs
- **Long term** effects (animal studies):
 - Increased impulsivity
 - Decreased attention performance

Nicotine and the Teen Brain



Cigarettes and Alternate Tobacco Products

- **All forms** of tobacco and nicotine products **carry important health risks for youth**
- Even if the health risks might seem smaller for some tobacco products when compared with others, all tobacco and almost all vaping products contain **nicotine**, which can lead to **increased use and addiction**.
- Tobacco/vaping **is not safe** in any amount or form

Smoking/Vaping Prevention and Cessation

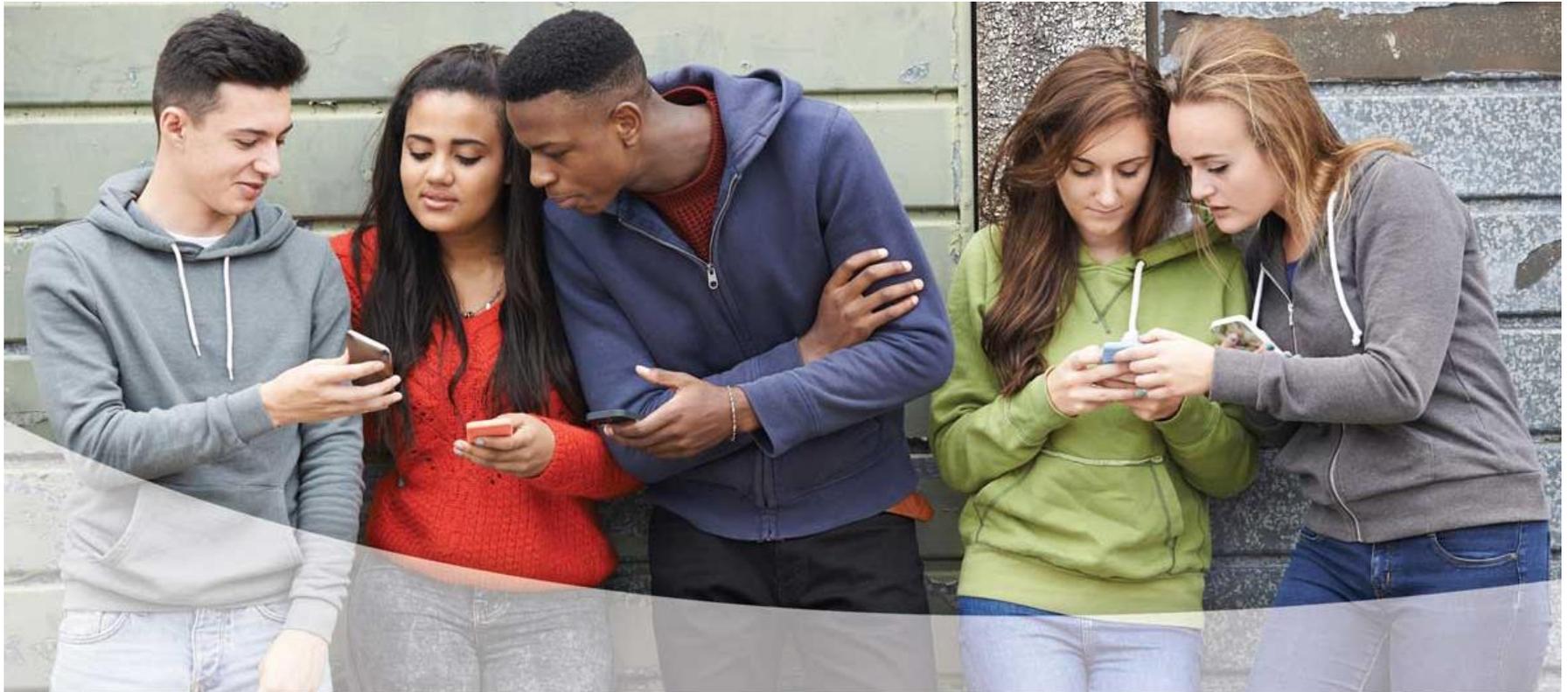
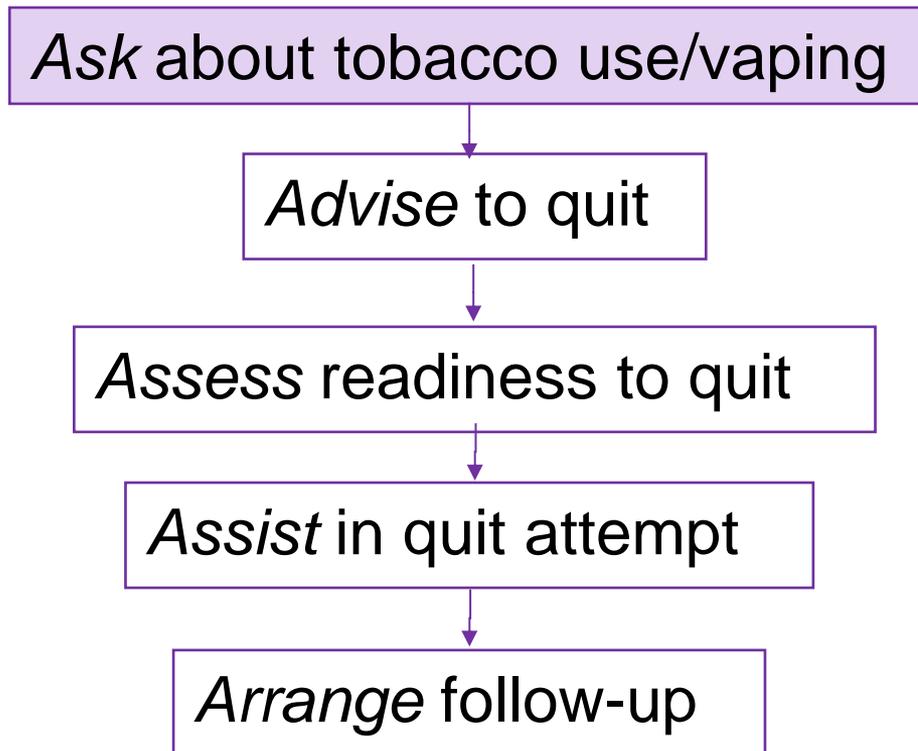


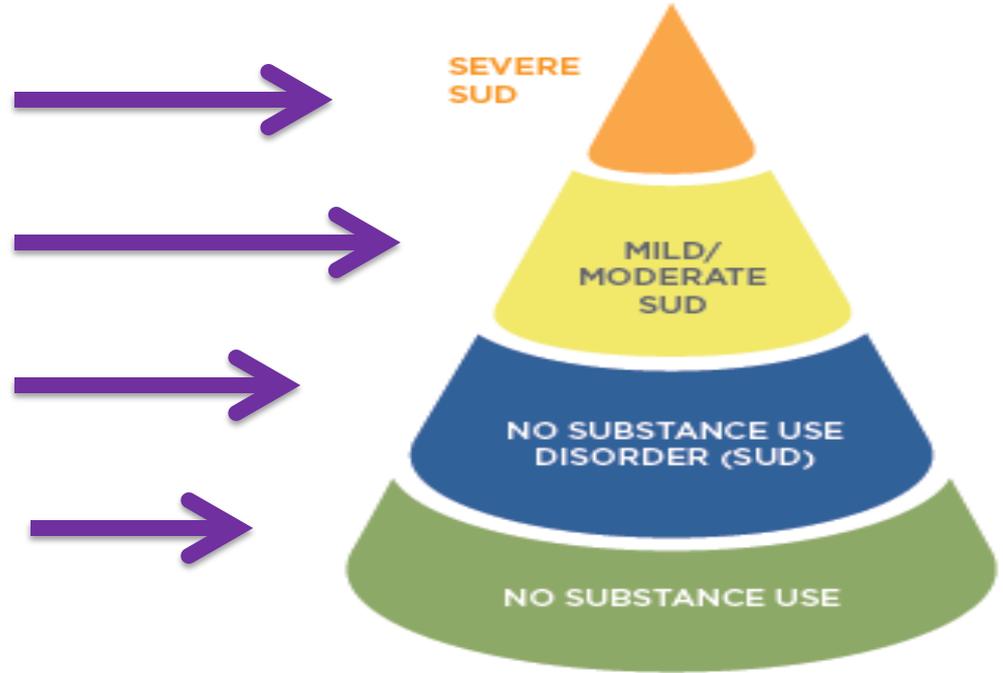
Photo credit: National Centers for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention

The 5 As



Screening to Brief Intervention (S2BI)

S2BI In the past year, how many times have you used:	
• Tobacco?	• Weekly • Monthly
• Alcohol?	• Once or twice • Never
• Marijuana?	• Never



AAP SBIRT Guidelines¹

Use validated screening tool to identify risk level and appropriate intervention

Abstinence

Positive Reinforcement

Substance use without a disorder

Brief Health Advice

Mild/moderate substance use disorder

Brief Intervention

Severe substance use disorder

Referral to Treatment

Note: Evidence is mixed² for the effectiveness of SBIRT for individuals with substance use disorders

1. Levy SJL, Williams JBW (2016). Substance Use Screening, Brief Intervention, and Referral to Treatment. Pediatrics. June 2016.
2. Mitchell SG et al. (2013). SBIRT for adolescent drug and alcohol use: Current status and future directions, J Subst Abuse Treat

Brief Counseling

- Tobacco/vaping counseling by health providers **can reduce** smoking initiation in children and adolescents¹
 - RR 0.81 [95% CI, 0.70 to 0.93]
- Different counseling modalities:
 - **Face-to-face** encounters (i.e. motivational interviewing, CBT)
 - **Phone** interactions
 - Provision of **print material**
 - Directing patients towards **online sources of information**
- Guidance to parents and families
 - Important to make content **age and context-specific**
 - Adolescents need more **short-term/concrete elements** vs long-term consequences

1. Pathnode CD, et al. (2013). Primary care-relevant interventions for tobacco use prevention and cessation in children and adolescents: a systematic evidence review for the U.S. Preventive Services Task Force. Ann Intern Med.

Age-Specific Counseling: Parents

Most compelling information

Effects of second-hand smoke on household members:

- Higher rates of asthma, colds, pneumonia, and ear infections, even if parents do not smoke in the house
- Increased rates of heart disease in the long term
- Children more likely to become smokers if parents smoke

Personal risks:

- Increased rates of heart disease, lung cancers and diseases, other cancers
- Infertility, prematurity and stillbirth, effects on fetal brain development

Age-Specific Counseling: School Age (5-11 years old)

Most compelling information

Immediate effects of smoking:

- Bad breath and smell, yellow teeth
- Harder to keep up in sports
- Even trying smoking just a few times can get you hooked

Long-term consequences:

- Cigarettes are expensive: could use money for more fun things
- Tobacco companies use ads to try to trick you into thinking that smoking is cool and safe
- Long-term effects on health, including cancer, heart attacks
- It is illegal to buy cigarettes when you are under-age

Age-Specific Counseling: Adolescents

Most compelling information

Immediate effects of smoking

- Cosmetic effects (smell, breath, yellow teeth, early wrinkles)
- Endurance and athletic performance
- Hacking coughs, more colds and pneumonias
- Potential for addiction after smoking as few as 100 cigarettes
- Cigarette smoking is expensive (between \$1500-\$3500/year)

Long-term health consequences:

- Selected long-term health risks (as mentioned in “Parents”)
- Alternate forms (snuff, e-cigarettes) no safer than cigarettes
- Smoking exposes friends and family to health risks from second hand smoke

Factors Impacting Teen Smoking Cessation

- **Age/sex** (male sex and older teens more likely to quit)
- **Education/cultural context**
- **Psychological conditions**, drug and alcohol consumption
- **Excess weight/weight** preoccupation (less likely to quit)
- **Physical health** conditions and chronic illness
- CYP2A6 **slow nicotine metabolizer** (more likely to quit)
- **Peer and family** tobacco use and support for cessation
- **Access** to tobacco products
- **Time** availability
- **Knowledge**, attitudes, and beliefs about tobacco
- **Behavioral skills**
- **Pregnancy** and parenthood

Factors Impacting Teen Smoking Cessation

- Important considerations:
 - The need to **experiment**
 - Dealing with **anxiety and stress**
 - Fear of gaining **weight**
 - Fear of **peer-rejection**
 - The need for **control**/independence
 - The need for **privacy**
 - LGBTQ: Smoking rates **2-3 times higher**

Teen Smoking Cessation: Medications

A. Nicotine Replacement Therapy

- Recent guidelines encourage single or dual NRT in **regular smokers ages 12 and above**
 - Acceptable safety profiles
- Potential **side effects**:
 - Mouth and skin irritation, ↑ HR/BP
- **Most recommended**:
 - Gums, lozenges and transdermal patches
 - Nicotine inhalers: not recommended
- **Contraindications**: post-surgery, arrhythmia

Teen Smoking Cessation: Medications

- **B. Bupropion**
 - Small number of trials, non significant effects
 - **Recommended in some cases** mostly based on expert opinion
- **C. Varenicline**
 - Small number of trials, non significant effects
 - **Recommended in some cases** mostly based on expert opinion
- **D. Others:**
 - Data about **Tricyclics, clonidine** and **cytisine** (partial nicotine agonist) is insufficient to recommend use

E-cigarettes for Smoking Cessation?



National Academies of Sciences, Engineering and Medicine (2018). Public Health Consequences of E-Cigarettes, Consensus Study Report

- There is **conclusive evidence** that:
 - Nicotine exposure and emissions of other potentially toxic emissions from e-cigarettes are **highly variable**
 - Completely substituting cigarettes for e-cigarettes **reduces exposure** to a number of toxicants and carcinogens
- There is **substantial evidence** that:
 - E-cigarettes **increase the risk** of using tobacco cigarettes in youth/young adults
- E-cigarettes should **NOT** be used for smoking cessation in adolescents

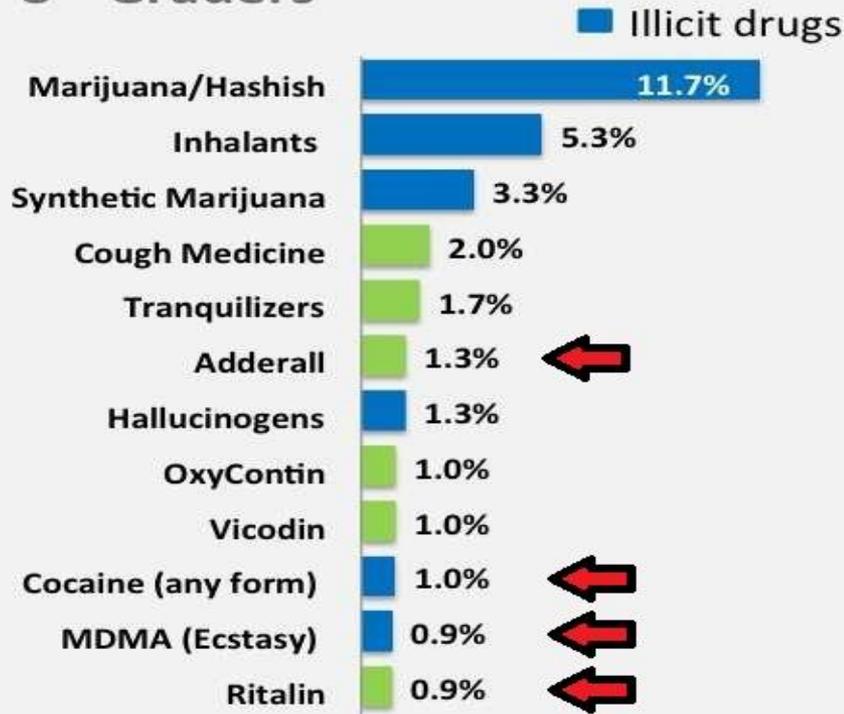
Stimulants



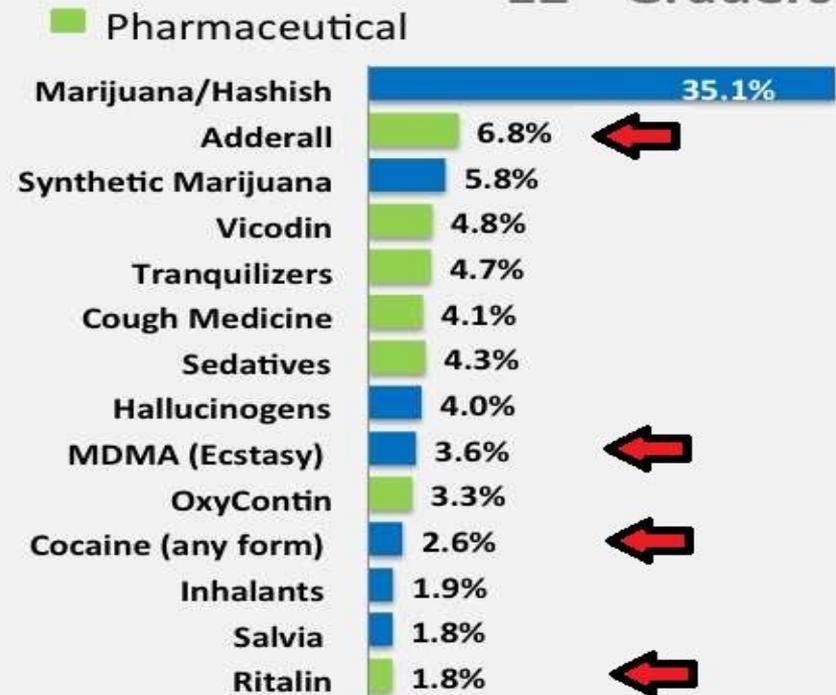
Stimulants: Epidemiology

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

8th Graders



12th Graders



Illicit Stimulants

Street Names	Commercial Names	Common Forms	Common Ways Taken
Cocaine: Blow, Bump, C, Candy, Charlie, Coke, Crack, Flake, Rock, Snow, Toot	Cocaine hydrochloride topical solution (anesthetic, rarely used)	White powder, whitish rock crystal	Snorted, smoked, injected
Ecstasy/MDMA: Molly, Adam, Clarity, Eve, Lover's Speed, Peace, Uppers	No commercial uses	Colorful tablets with imprinted logos, capsules, powder, liquid	Swallowed, snorted
Methamphetamine: Crank, Chalk, Crystal, Fire, Glass, Go Fast, Ice, Meth, Speed	Desoxyn [®]	White powder or pill; crystal meth looks like pieces of glass or shiny blue-white “rocks” of different sizes	Swallowed, snorted, smoked, injected

Cocaine

- Use and accessibility have been steadily decreasing in adolescents since 1999 and are now at a historic low
- **Acute effects:**
 - Psychological: Euphoria, increased energy, restlessness, anxiety, paranoia, psychosis
 - Physiological: vasoconstriction; mydriasis; hyperthermia, tachycardia, hypertension, nausea
 - Acute hazards: arrhythmia, stroke, seizures, coma
- **Long term effects:** Anosmia, nosebleeds, nasal damage and trouble swallowing from snorting, bowel ischemia, poor nutrition and weight loss.

MDMA/Ecstasy

- Recent **increase in popularity** among young adults (not in adolescents)
- Both a stimulant and a hallucinogen
- Frequently laced with other substances including opioids (i.e. fentanyl), risk of overdose with one single pill
- **Short term effects:**
 - Psychological: ↓ inhibition, ↑ sensory perception
 - Physiological: Tachycardia, hypertension, hyperthermia, muscle tension, nausea, faintness
 - Hyperthermia/dehydration can lead to kidney failure
- **Long-term effects:** Long-lasting confusion, depression, problems with attention, memory, and sleep, increased anxiety, impulsiveness, decreased libido

Methamphetamine

- Use had been decreasing in both adolescents and young adults since the turn of the century (although increase in 2017)
 - Very high risk perception
- Methamphetamine is **structurally similar to amphetamines**, produces similar effects, but has important differences:
 - Onset is quicker, effects can be stronger
 - Users will often use repeatedly and go on “binges”
- **Short term effects:** Increased wakefulness and physical activity; decreased appetite; tachycardia, hypertension, hyperthermia, arrhythmia
- **Long term effects:** Anxiety, confusion, insomnia, mood problems, violent behavior, paranoia, hallucinations, delusions, weight loss, severe dental problems (“meth mouth”), intense itching leading to skin sores from scratching

Illicit Stimulants: Treatment

- **No FDA-approved medications** to treat stimulant addiction
 - Experimental trials for cocaine: baclofen, tiagabine, topiramate, antipsychotics, modafinil, disulfiram (inconclusive)
 - Experimental trials for methamphetamine: naltrexone, bupropion, mirtazapine (limited evidence)
- **Behavioral therapies:**
 - Cognitive-behavioral therapy (CBT)
 - Contingency management/motivational incentives, including vouchers/gift cards
- **Community-based recovery groups:**
 - 12 Step programs
- Prescription apps (Approved by the FDA for alcohol, cannabis and cocaine disorders)

Harm Reduction

- Using **with others**, never alone
- **Pre-testing** dose (starting with a small dose)
- **Naloxone** rescue kits for use on self or others (as stimulants often laced with opioids)
- **If injecting**: clean needles, no sharing, no reusing
- **Test strips** for Fentanyl and derivatives:
 - High sensitivity and specificity if proper technique
 - Need to dissolve in water (if tablets, need to crush)



Prescription Stimulants



Prescription Stimulants

Street Names	Commercial Names	Common Forms	Common Ways Taken
Bennies, Black Beauties, Crosses, Hearts, LA Turnaround, Speed, Truck Drivers, Uppers	Amphetamine (Adderall ®)	Tablet, capsule	Swallowed, snorted, smoked, injected
JIF, MPH, R-ball, Skippy, The Smart Drug, Vitamin R	Methylphenidate (Concerta ®, Ritalin ®)	Liquid, tablet, chewable tablet, capsule	Swallowed, snorted, smoked, injected, chewed

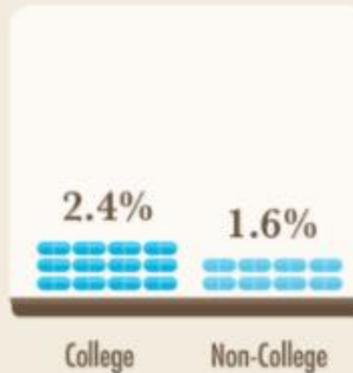
Prescription Stimulants

2016 Monitoring the Future College Students and Young Adults Survey Results



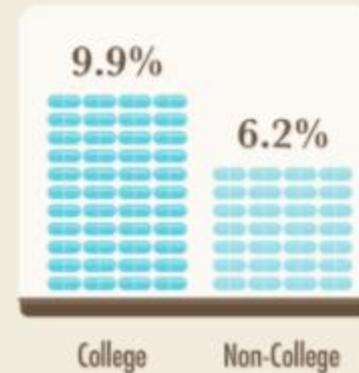
RITALIN

Past-Year Use



ADDERALL

Past-Year Use



Prescription Stimulants

Drug	Time Period	8th Graders (%)	10th Graders (%)	12th Graders (%)
Amphetamine	Lifetime	5.70	8.20	9.20
	Past Year	3.50	5.60	5.90
	Past Month	1.70	2.50	2.60
Adderall	Past Year	1.30	4.00	5.50
Ritalin	Past Year	0.40	0.80	1.30

Prescription Stimulants

- Use in adolescents has been **decreasing** in the past 5 years but remains high among young adults
- **Short-term effects:**
 - **Psychological effects:** Increased alertness, attention, energy
 - **Physiological effects:** Hypertension, tachycardia, vasoconstriction, hyperglycemia
 - **High doses:** Hyperthermia, arrhythmia, seizures
- **Long-term effects:** QT prolongation (risk for arrhythmia), anger, psychosis, paranoia

Source of prescription stimulants for non-medical use in US population 12 and above

Sources	Frequency (%)
Friends/relatives source	75
• Got for free	52
• Bought from friend/relative	18
• Took without asking	5
Physician source	11
• Got one or more prescriptions from 1 doctor	10
• Got prescriptions from more than 1 doctor	1
Illegal source	10
• Fake prescriptions	<1
• Stole from clinic, hospital or pharmacy	1
• Bought from drug dealer	7
• Bought over the Internet	2
Other source	4

Adapted from: Chen LY, Strain EC, Crum RM, Storr CL, Mojtabai R (2015). Sources of nonmedically used prescription stimulants: Differences in onset, recency and severity of misuse in a population-based study, *Drug and Alcohol Depend*, 156(1):106-112

Substance Use and ADHD

- Children/youth with ADHD are **2.5 times more likely** than their peers to develop substance use disorders
- ADHD also associated with an **earlier onset** of substance use and higher likelihood of using multiple substances
- Treatment with stimulants may **reduce the risk** of substance use disorders, although evidence is mixed
- Suggested screening questions (not yet validated):
 - Have you ever shared or sold your medication?
 - Have you ever taken a larger dose than prescribed?
 - Have you ever taken your medication more often than prescribed?

Harstad L, Levy S (2014). Attention-Deficit/Hyperactivity Disorder and Substance Abuse, Pediatrics, 134(1)

Zulauf CA et al (2014). The Complicated Relationship Between Attention Deficit/Hyperactivity Disorder and Substance Use Disorders, Curr Psychiatry Rep, 16(3): 436

Substance Use and ADHD

Strategies to **reduce the risk of stimulant misuse**:

- Optimize behavioral (non-pharmacological) management of ADHD
- Safe prescription and documentation practices:
 - Regular follow-up (i.e. every 1-6 months)
 - Single prescriber
 - Avoid early refills
- Use formulations with lower abuse potential:
 - Longer acting vs shorter acting
 - Non-stimulant medications (although often less effective)
- Direct observation treatment, keep medication locked

Prescription Stimulants: Approach

- Need to **confirm or rule-out** ADHD
 - Detailed history and work-up: clarify nature and onset of symptoms (if present)
 - Previous diagnoses (i.e. ADHD, learning disability)
 - Consider referral for neuro-psychological testing
- **No FDA-approved** medications to treat stimulant use disorder
 - Behavioral therapies used for illicit stimulants may be useful (CBT, contingency management)
 - Mobile medical application
- Treat/address comorbidities:
 - Other substance use disorders
 - Mental health comorbidities (i.e. anxiety, depression)

Caffeine



Caffeine

- Caffeine is the most widely-used psychoactive substance in the world
- Use of caffeine in adolescents in the US has more than doubled since 1980:
 - $\approx 75\%$ of adolescents consume caffeine each day
- Caffeine has different effects on males and females after puberty:
 - Stronger **cardiovascular, reinforcing and subjective** responses in boys vs girls

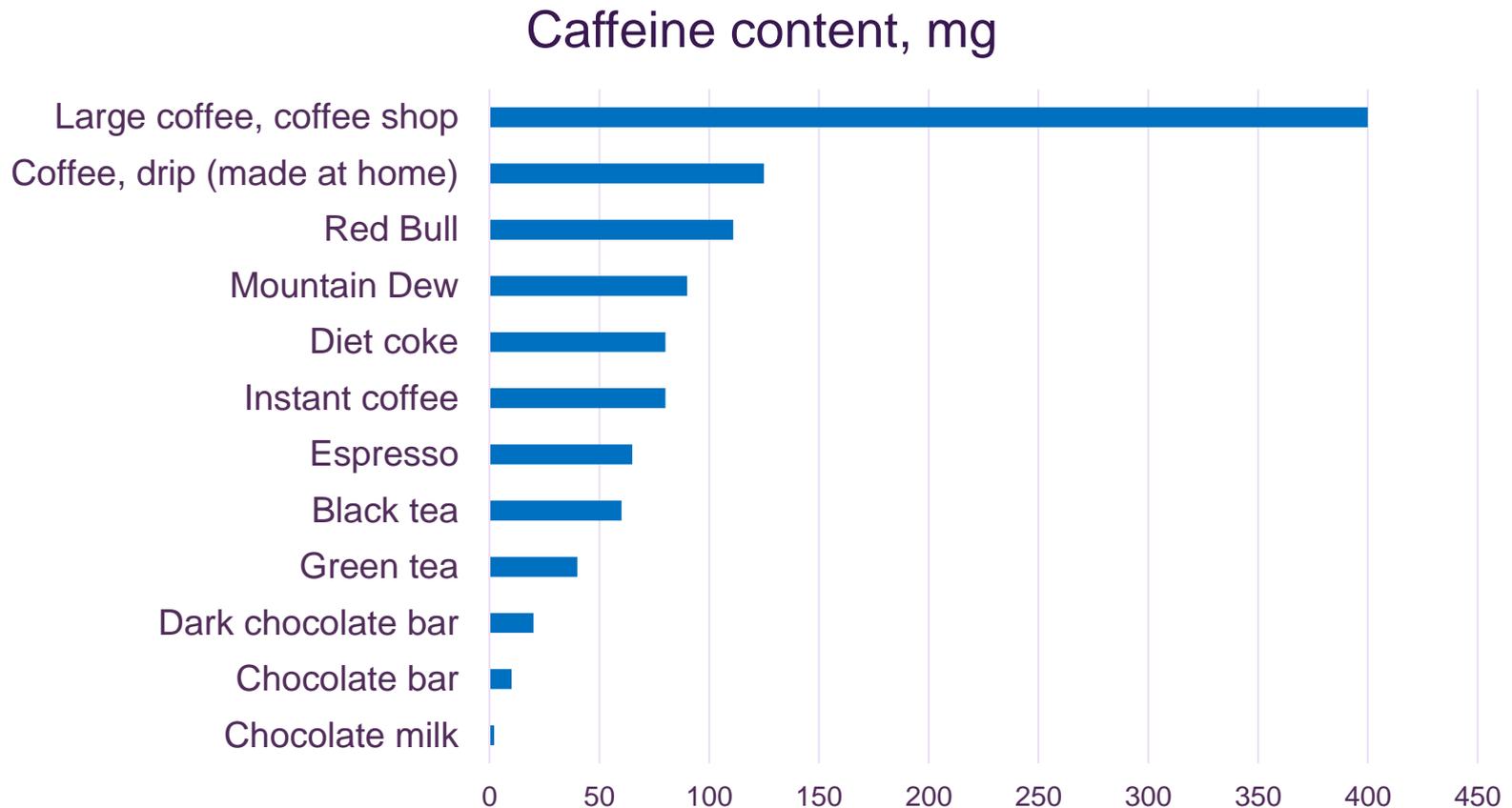
Caffeine: Health Risks

- Caffeine use produces **greater tolerance** in teens vs adults
 - Animal studies: caffeine use during adolescence is associated with a greater sensitivity to **cocaine and other illicit drugs** in adulthood
 - Effects not seen if caffeine exposure starts in adulthood

Caffeine: Health Risks

- Caffeine consumption is associated with increased **risk-taking, impulsivity, and sensation seeking** in teens
 - Association is stronger in boys, who also consume greater quantities of caffeine than girls
 - Unclear if caffeine is a cause or if youth who are more prone to risk-taking are also more prone to caffeine use
- The American Academy of Pediatrics recommends a maximum of **100mg of caffeine per day** for adolescents under 18 (but preferably no caffeinated beverages at all)
 - The FDA recommends < 400mg per day in adults

Approximate caffeine content of common beverages



Energy Drinks

- Contain approximately 50-80 mg of caffeine per 8oz (a cup of coffee usually contains \approx 100-125mg)
- College students who regularly consume energy drinks are at a greater risk for future **alcohol use disorder**, **cocaine use** and misuse of **prescription stimulants**
 - Association (not a causal study)
- Death of a 16-year old teenager in 2017:
 - Caffeine-induced cardiac arrhythmia
 - Ingestion of a latte coffee, a large Mountain Dew and an energy drink
 - Caution is advised

Caffeine Powder

- **Caffeine powder** is an emerging health hazard for youth: available online, often marketed for weight loss
- A teaspoon of pure caffeine powder is equivalent to approximately 25 cups of coffee (2700mg of caffeine)
 - This is a lethal dose for an adolescents (or adult)
 - Other acute effects: Tachycardia, palpitations, arrhythmia, seizures, diarrhea, vomiting, disorientation
- Death of an Ohio high school student in 2014 prompted a FDA safety advisory about caffeine powders
 - April 2018: FDA statement providing recommendations for industry about highly concentrated caffeine in dietary supplements (non-binding)

Conclusion



Photo credit: National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control

Take Home Messages: Nicotine

- Nicotine has important **deleterious effects** on the developing teen
- Cigarettes and e-cigarettes are **never safe** for children and adolescents
 - E-cigarettes are associated with increased use of tobacco products and other substances
- **Screening and brief intervention** by health providers can delay the onset of smoking/vaping and should be included in all teenage health encounters
- **Nicotine replacement** therapy should be considered in adolescents who are daily users

Take Home Messages: Stimulants

- Rates of stimulant use (prescription and non-prescription) are **decreasing** in adolescents
- Untreated ADHD is a **risk factor** for substance use; caution is needed when treating youth with stimulants which have a potential for misuse and diversion
- There is **no approved** pharmacological treatment for stimulant abuse
- **Behavioral interventions** including CBT and contingency management should be considered first line of treatment
- Caffeinated beverages and caffeine powder can be **dangerous** and even lethal if misused

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PCSS Mentor Program

- PCSS Mentor Program is designed to offer general information to clinicians about evidence-based clinical practices in prescribing medications for opioid addiction.
- PCSS mentors are a national network of providers with expertise in **addictions, pain, evidence-based treatment including medication-assisted treatment.**
- 3-tiered approach allows every mentor/mentee relationship to be unique and catered to the specific needs of the mentee.
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PCSS-MAT is a collaborative effort led by the American Academy of Addiction Psychiatry (AAAP) in partnership with the: Addiction Technology Transfer Center (ATTC); American Academy of Family Physicians (AAFP); American Academy of Neurology (AAN); American Academy of Pain Medicine (AAPM); American Academy of Pediatrics (AAP); American College of Emergency Physicians (ACEP); American College of Physicians (ACP); American Dental Association (ADA); American Medical Association (AMA); American Osteopathic Academy of Addiction Medicine (AOAAM); American Psychiatric Association (APA); American Psychiatric Nurses Association (APNA); American Society of Addiction Medicine (ASAM); American Society for Pain Management Nursing (ASPMN); Association for Medical Education and Research in Substance Abuse (AMERSA); International Nurses Society on Addictions (IntNSA); National Association of Community Health Centers (NACHC); National Association of Drug Court Professionals (NADCP), and the Southeast Consortium for Substance Abuse Training (SECSAT).

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