MARIJUANA USE IN TEENS: SHIFTING THROUGH THE WEEDS

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Adolescent substance abuse is a complex phenomenon that includes diverse drugs, diverse usage patterns and differing etiologies.

There is increasing information that addiction is a central nervous system disease with specific structural and/or functional changes within the brain that are genetically determined but triggered by particular substances.
Substance Use Facts

- Adolescent substance use while not normative is prevalent
- Most often adolescent drug use is co-occurring
- Adolescents have a higher likelihood of dependence with use
- Substance use impacts normal development and academic achievements
- Alcohol and marijuana are the most used illicit/licit substances worldwide
- Marijuana use has been linked with first episode psychosis in at-risk adolescents and young adults
What is Marijuana (Cannabis)?

Also known as:
- Blunt, Boom, Bud, Gangster, Ganja, Grass, Green, Hash, Herb, Joint, Pot, Reefer, Sinsemilla, Skunk, & Weed

-Marijuana is the dried leaves and flowers of the *Cannabis sativa* or *Cannabis indica* plant. Stronger forms of the drug include high potency strains - known as sinsemilla (sin-seh-me-yah), hashish (hash for short), and extracts including hash oil, shatter, wax, and budder.

-Of the more than 500 chemicals in marijuana, *delta-9-tetrahydrocannabinol*, known as THC, is responsible for many of the drug’s psychotropic (mind-altering- make a person high ) effects.
Cannabis

- **Sativa, Indica, Ruderalis**

**Over 60 Known Cannabinoids**
- Cannabinols, cannabidiols
- Delta 9 tetrahydrocannabinol

**Popular strains**
- Girl Scout Cookies
- Blue Dream
- Dutch Treat
- Gorilla Glue
- Sour Diesel
- OG Kush
- Grape Ape
- Cinex
- Green Crack
- White Tahoe Cookies
Cannabinoids

- *Cannabis sativa* contains about 86 cannabinoids
- Commercially, cannabinoids take 4 major forms
  - Medical marijuana
  - THC (dronabinol)
  - Cannabidiol (CBD)
  - Cannabinol (preferentially binds CB2)
THC potency - Weed is Getting Stronger

The amount of THC in marijuana has increased over the past few decades.

In the early 1990s, the average THC content in marijuana was less than 4% - now about 15% & much higher in some products such as oils & other extracts growing more potent strain called sinsemilla

THC negatively impacts brain development
A shift in cannabis landscape

• The legalization of cannabis for medical and recreational uses has increased over the past decade.

• This policy change has been motivated by the growing social acceptability.
LEGAL STATUS OF MARIJUANA

As of 2019:

- **47 out of 50** States and the District of Columbia have passed laws that permit use of marijuana for medical purposes; -- Michigan is one of them (2008)
- **11 states** (Alaska, California, Colorado, Illinois, Maine, Massachusetts, Michigan, Nevada, Oregon, Vermont, and Washington) and District of Columbia have legalized recreational marijuana use. 2020 may lead to a few more joining them. New York, New Mexico, Minnesota, and Illinois are predicted to go fully legal fairly soon.
- in MI - adults 21 and older to possess up to **2.5 ounce of marijuana** and grow up to **12 plants** in their homes.
- **26 out of the 50** have undergone some **decriminalization of marijuana laws**
- Nonetheless, marijuana possession, sale and use remain illegal by federal law, making its status ambiguous.
FEDERAL LAW CONTINUES TO PROHIBIT MARIJUANA

• Federal Controlled Substances Act – Marijuana is a Schedule I Drug, meaning “no currently accepted medical use.”

• Under the Obama administration the U.S. Department of Justice had agreed to not enforce Marijuana laws in states that have a “robust regulatory scheme for medical marijuana.” This policy was reversed by the Trump administration in 2018.

• Congressional appropriations bills have prohibited DOJ and AG from using federal funds to prevent states from allowing medical marijuana.
Marijuana use among adolescents & young adults

- Whether legalization of Marijuana encourages use among adolescents is an important concern.

- Recent findings suggest that states with medical or recreational cannabis laws did not observe an increase in adolescent cannabis use.

- This might be explained by the fact that it is more difficult for teenagers to obtain marijuana as drug dealers are replaced by licensed dispensaries that require proof of age.

The AAP opposes legalization of marijuana because of the potential harms to children and adolescents.

The **AAP advocates for decriminalization of marijuana**- Decriminalization is distinct from legalization. Decriminalization is meant to reduce penalties for use and possession to misdemeanors. It does not allow for the formation of a legal marijuana industry that could sell and develop the product.

The AAP opposes "medical marijuana" laws or the use of marijuana as a medication outside the standard FDA regulatory process.

Although the AAP does not condone state laws to legalize marijuana, in states where recreational use of marijuana is legal, regulations should include strict penalties for those who sell marijuana to people younger than 21 years.

In states where marijuana is sold legally, either for medicinal or recreational purposes, regulations should be enacted to ensure marijuana is distributed in child-proof packaging to prevent accidental ingestion.

The **AAP discourages adults from using marijuana in the presence of children** because of the influence of role modeling by adults on child and adolescent behavior.

The AAP strongly supports research & development of pharmaceutical cannabinoids & supports a review policies promoting research on the medical use of Marijuana.
Marijuana Regulation

Licensing, Tracking & Regulatory Responsibilities

Andrew Brisbo, MRA Executive Director
www.michigan.gov/MRA
MARIJUANA TIMELINE - MI

2008
- Legalization of Medical Marijuana

2018
- Voting Ballot Recreational legalization with Prop 1

2019
- Shops able to sell Marijuana for recreation

2020
- Recreational sales outperform medical
LEGALIZATION DAY

As of Dec. 6, Michigan is the first state in the Midwest to legalize adult-use recreational marijuana.

- Adults 21 and up are permitted to possess and consume marijuana.
- Up to 2.5 ounces can be possessed and transported at any time.
- Up to 10 ounces can be kept at home; amounts higher than 2.5 ounces must be locked away.
- Up to 12 marijuana plants can be grown in the home; more with a proper license.

- Driving under the influence of marijuana is prohibited.
- Consumption of marijuana in public is prohibited.
- Municipalities may ban retail sales of marijuana, but cannot ban consumption by adults 21 and up.

Note: Marijuana retail sales are not expected to begin until 2020.
MI MJ Regulatory agency put restrictions

- Edibles cannot be sold in packages that are attractive to children or confused with non-marijuana candy brand.
- Packaging must be opaque, resealable, child-resistant; CO defines and limits serving size.
- Retailer cannot be within 1000 feet of a school.
Monitoring the Future is an annual survey of 8th, 10th, and 12th graders conducted by researchers at the Institute for Social Research at the University of Michigan, Ann Arbor, under a grant from the National Institute on Drug Abuse, part of the National Institutes of Health. Since 1975, the survey has measured how teens report their drug, alcohol, and cigarette use and related attitudes in 12th graders nationwide; 8th and 10th graders were added to the survey in 1991.

42,531 students from 396 public and private schools participated in the 2019 survey.
ALCOHOL USE CONTINUES ITS DECLINE

PAST YEAR ALCOHOL USE
Significant long-term decrease in all grades

BINGE DRINKING*
Significant long-term decrease in all grades

*5 or more drinks in a row in the past two weeks

NIH
National Institute on Drug Abuse

DRUGABUSE.GOV
DAILY MARIJUANA USE IN LOWER GRADES INCREASES BUT PAST YEAR MARIJUANA USE STEADY

DAILY MARIJUANA USE
sees significant increase among 8th and 10th graders since 2018

<table>
<thead>
<tr>
<th>Year</th>
<th>8th Graders</th>
<th>10th Graders</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>2%</td>
<td>1.3%</td>
</tr>
<tr>
<td>2018</td>
<td>4.8%</td>
<td>6.4%</td>
</tr>
<tr>
<td>2019</td>
<td>6.4%</td>
<td></td>
</tr>
</tbody>
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PAST YEAR MARIJUANA USE
gap closing between older grades

<table>
<thead>
<tr>
<th>Year</th>
<th>8th Graders</th>
<th>10th Graders</th>
<th>12th Graders</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>11.8%</td>
<td>28.8%</td>
<td>35.7%</td>
</tr>
<tr>
<td>2018</td>
<td>11.8%</td>
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NIH National Institute on Drug Abuse
DRUGABUSE.GOV
TEEN VAPING CLIMBS SIGNIFICANTLY*

THC VAPING
Past month use

<table>
<thead>
<tr>
<th>Year</th>
<th>8th graders</th>
<th>10th graders</th>
<th>12th graders</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>3.9%</td>
<td>3.9%</td>
<td>3.9%</td>
</tr>
<tr>
<td>2018</td>
<td>12.6%</td>
<td>12.6%</td>
<td>12.6%</td>
</tr>
<tr>
<td>2019</td>
<td>14%*</td>
<td>14%*</td>
<td>14%*</td>
</tr>
</tbody>
</table>

DAILY THC VAPING
Measured for the first time in 2019

<table>
<thead>
<tr>
<th>Grade</th>
<th>THC Vaping</th>
</tr>
</thead>
<tbody>
<tr>
<td>8th graders</td>
<td>0.8%</td>
</tr>
<tr>
<td>10th graders</td>
<td>3.0%</td>
</tr>
<tr>
<td>12th graders</td>
<td>3.5%</td>
</tr>
</tbody>
</table>


To view information on other drugs from the 2019 Survey visit:

NIH
National Institute on Drug Abuse

DRUGABUSE.GOV
A shift in Marijuana landscape

- Perceptions that marijuana use involves a great risk have declined.
- The prevalence of marijuana use has increased among all age groups.

Perceived Great Risk from Smoking Cannabis Once a Month among People Aged 12 or Older, by Age Group

Kids are less likely to use marijuana if they believe their parents or their communities disapprove of youth using marijuana.

**Relationship between Marijuana Use and Perceived Parental and Community Norms, Grade 10, 2014**

- **What does this chart say?**
  - Statewide, 10th graders are less likely to use marijuana if they believe their parents think it is wrong for them to use.
  - Statewide, 10th graders are less likely to use marijuana if they believe their community thinks it is wrong for them to use.
ANATOMY OF A TEENAGER'S BRAIN

THE BIRDS AND THE BEES LOBE

MEMORY FOR MUSIC

REBELLION CENTER

SUPER TURBO REBELLION CENTER

SELF IMAGE

FITTING IN GLAND

INTERNET/PHONES

PEER PRESSURE

RESISTANCE

ANALYSIS CENTER

EVERY EPISODE OF THE SIMPSONS

INDESTRUCTIBILITY CORTEX

CAR KEYS

CRAVING

ABILITY TO BE SEEN IN PUBLIC WITH PARENTS

SLAM DOOR REFLEX

PARENTS' CRINGE

ALL THE ANSWERS

LIKE FOR PARENTS

DUNDIES

DISTRACTIONS

FUNCTION CENTER

MEMORY FOR CHORES, HOMEWORK, ETC.

JUDGEMENT GLAND

SLANG DECODER

"COOL" GAUGE

PRONE TO BRUISING
Research has shown that brain development continues into the second decade - early twenties

Adolescence: Vulnerabilities

• There is a peak in sensation seeking
  – Sensation seeking can lead to risk-taking behaviours
• Substance abuse, unprotected sex, extreme sports, suicide
  - Most drugs of abuse lead to a general blunting of dopamine release which contributes to poor outcomes
Adolescent Brain Development

- Continues to develop into early adulthood
- Additional connections between nerve cells
- Pruning of existing connections
- Prefrontal cortex and amygdala remodeling
Growing a Grown-up Brain

Scientists have long thought that the human brain was formed in early childhood. But by scanning children’s brains with an MRI year after year, they discovered that the brain undergoes radical changes in adolescence. Excess gray matter is pruned out, making brain connections more specialized and efficient. The parts of the brain that control physical movement, vision, and the senses mature first, while the regions in the front that control higher thinking don’t finish the pruning process until the early 20s.

**Gray matter**

- **Gray matter becomes less dense as the brain matures.**
- **More dense**
- **Less dense**

**Parietal lobe:** Spatial perception

**Occipital lobe:** Vision

**Temporal lobe:** Memory, hearing, language

**Frontal lobe:** Planning, emotional control, problem solving

The prefrontal cortex, which is responsible for higher-order cognitive functions like decision making & problem solving, is particularly Susceptible to the effects of Marijuana.
Brain Cannabinoid System

- Brain has cannabinoid receptors (CB1 and CB2)
- Anandamine is brain endocannabinoid
- This system involved in
  - Brain growth
  - Regulation of other neurotransmitters
  - Executive functioning skills, memory, reward processing
- Plant THC stronger and longer lasting effect than anandamine
- Brain “adolescence” continues into mid-20s and not at age 21
THC’s chemical structure is similar to the brain chemical anandamide. Similarity in structure allows drugs to be recognized by the body and to alter normal brain communication.
The Long Term Effects of Marijuana on the Teen Brain
When marijuana is smoked, its active ingredient, THC, travels throughout the body, including the brain, to produce its many effects. THC attaches to sites called cannabinoid receptors on nerve cells in the brain, affecting the way those cells work. Cannabinoid receptors are abundant in parts of the brain that regulate movement, coordination, learning and memory, higher cognitive functions such as judgment, and pleasure.
Cannabis Changes the Brain

Long-term effects of marijuana use on the brain

Francesca M. Filbey\textsuperscript{a,3}, Sina Aslan\textsuperscript{a,b}, Vince D. Calhoun\textsuperscript{c,d}, Jeffrey S. Spence\textsuperscript{b}, Eswar Damaraju\textsuperscript{c}, Arvind Caprihan\textsuperscript{c}, and Judith Segall\textsuperscript{c}

- Multiple studies show link between cannabis use and changes in both brain anatomy and function
- Many of these show evidence that link between MJ and cognitive problems mediated through these brain changes
- Evidence of functional compensation
- Effect strongest for earlier use
  - Abnormal brain pruning

Fig. 1. Group comparison of the gray matter volume by SPMS plus DARTEL analysis demonstrates significant reduction of gray matter volume in bilateral orbitofrontal gyri (AAL atlas) in marijuana users compared with controls. Right side of the image represents the right hemisphere in axial view.

Cannabis Use Is Quantitatively Associated with Nucleus Accumbens and Amygdala Abnormalities in Young Adult Recreational Users

Effect of high-potency cannabis on corpus callosum microstructure
# Acute Effects

<table>
<thead>
<tr>
<th>Increased heart rate 20 to 100 times normal</th>
<th>4.8 fold increase in chance of having a heart attack within 1st hour after using drug</th>
<th>Euphoria, relaxation, change in pain sensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distorted sensory perception</td>
<td>Thought and time distortion</td>
<td>Slowed reaction time to stimuli</td>
</tr>
<tr>
<td>Hallucinations, paranoia, anxiety, psychosis</td>
<td>Memory impairment</td>
<td>Excessive vomiting</td>
</tr>
</tbody>
</table>
Mental Health Effects

Young people who use marijuana weekly have double the risk of depression later in life.

Teens aged 12-17 who smoke marijuana weekly are three times more likely than non-users to:

- Have suicidal thoughts.
- Possible increased risk for schizophrenia in later years.
In a recent study sponsored by NIDA and the National Institute of Mental Health, teens who used marijuana lost IQ points relative to their nonusing peers.

Figure. Teens Using Marijuana Show Declines in Verbal IQ
Marijuana use between the ages of 9 and 12 and 17 and 20 was associated with declines of 3.4 points in verbal IQ in the MTFS and 4 points in the RFAB.
Marijuana Consumption

**blunt**
Cannabis is rolled in a cigar that is cut, removed of tobacco, and resealed.

**bong**
Combusted cannabis is bubbled through water, then resulting smoke is inhaled.

**dabbing**
Cannabis products are chemically dissolved in vapors of flammable solvent, such as butane or isopropyl alcohol, which is then inhaled.

**g-pen**
Cannabis is concentrated into wax, oil or hash and vaporized through an e-cigarette.

**hookah**
Cannabis is mixed with flavored tobacco, burned with charcoal. Smoke bubbles through water and is inhaled.

**joint**
Cannabis is rolled in paper and smoked like a cigarette.

**pipe**
Cannabis product is lit and smoked in a glass pipe.

**vaporizer**
Cannabis is heated to about 338°F, below burning temperature, and vapors are inhaled.
Smoking Cannabis: Joints & Blunts

• Joint: cannabis flowers in a thin paper made for rolling cigarettes

• Blunt: cannabis flower in cigar tobacco leaf

• 5-10 seconds to feel the effect

• High lasts 30 minutes to several hours

• THC concentration depends on cannabis flower used
Inhalation

- Smoke is inhaled deep into the lungs
- Damages the respiratory system
- Blunts introduce nicotine, which is extremely addictive
- “Vaping” cannabis is not a safe alternative
Aerosolizing or “Vaping”

- THC concentrate is aerosolized
- 5-10 seconds to feel the effect
- High lasts 30 minutes to several hours
- THC concentration depends on liquid; often mislabeled
- Not harmless
Pipes and Bongs

- Pipe: cannabis flower is burned and its smoke is inhaled
- Bong: flower is burned, its smoke is cooled through water then inhaled
- 5-10 seconds to feel the effect
- High lasts 30 minutes to several hours
- THC concentration depends on cannabis flower used
Dabbing

- Concentrated THC wax is heated, the aerosol is then inhaled
- 5-10 seconds to feel the effect
- High lasts 30 minutes to several hours
- ~80% THC concentration
- One of the methods most associated with emergency room visits
Edibles

- Cannabis infused foods and drinks
- 20 min – 2 hours to feel the effects
- High typically lasts for hours
- THC concentration varies greatly and is difficult to measure accurately
- Very easy to over consume
Sprays, Tinctures, Capsules

• Sprays & tinctures: oil or alcohol-based liquids containing cannabis
• Capsules/pills: contain cannabis, usually floating in an oil
• 15 min – 2 hours to feel the effects
• Effects typically last for hours
• These products are not closely regulated, so there is no way to really know what they really contain.
**THC vs. CBD**

- THC is found to be effective in several conditions, however the psychoactive effects of THC limits its use in clinical care.

- Epidiolex is the only approved CBD drug and it is approved for only two rare and severe genetic forms of epilepsy.

- There is a need for additional studies to investigate the health benefits of CBD.

- Many restrictions exist in cannabis research.

- Cannabinoids used in research might not be representative of cannabinoids in the market.

- In addition, there are problems associated with medical cannabis labelling (Vandrey R et al. Cannabinoid Dose and Label Accuracy in Edible Medical Cannabis Products. *JAMA*. 2015).

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Average Δ9-tetrahydrocannabinol (Δ9-THC) concentration of DEA specimens by year, 1995 – 2014.

A Game Changer for Epilepsy
In the adult literature, similar presentations of recurrent cyclical vomiting, nausea and abdominal pain have been seen in chronic cannabis users.

This link between cyclic vomiting & chronic cannabis use has led to the recognition of new syndrome – cannabinoid hyperemesis syndrome (CHS):

- Recurrent nausea, cyclic vomiting, & abdominal pain
- Often associated with chronic marijuana use and relief of symptoms with hot showers

First described in Australia by Allen et al. in 2004.

Subsequently, more than 100 reported cases of CHS as a cause of cyclic vomiting in adults however, few published cases of CHS in pediatric population.

The AAP recommends that pediatricians:

- Become knowledgeable about all aspects of substance use, brief intervention, and/or referral to treatment algorithm (SBIRT) through training program curricula or continuing medical education that provide current best-practices training.

- Screen all adolescent patients for tobacco, alcohol, and other drug use with a formal, validated screening tool, such as the CRAFFT screen, at every health supervision visit and appropriate acute care visits, and respond to screening results with the appropriate brief intervention.

- Develop close working relationships with qualified and licensed professionals and programs that provide the range of substance use prevention and treatment services, including tobacco cessation, that are necessary for comprehensive patient care.

(Committee on Substance Abuse Pediatrics 2011;128:e1330-e1340)
THE CRAFFT SCREENING INTERVIEW FOR SUBSTANCE USE

• Begin: “I’m going to ask you a few questions that I ask all my patients. Please be honest. I will keep your answers confidential.”

• Part A
• During the PAST 12 MONTHS, did you: Yes or No

• 1. Drink any alcohol (more than a few sips)?
• (Do not count sips of alcohol taken during family or religious events.)
• 2. Smoke any marijuana or hashish?
• 3. Use anything else to get high?
• (“anything else” includes illegal drugs, over the counter and prescription drugs, and things that you sniff or “huff”)

HURLEY CHILDREN’S HOSPITAL
THE CRAFFT SCREENING TOOL

- **C** Have you ever ridden in a **CAR** driven by someone (including yourself) who was "high" or had been using alcohol or drugs?
- **R** Do you ever use alcohol or drugs to **RELAX**, feel better about yourself, or fit in?
- **A** Do you ever use alcohol/drugs while you are by yourself, **ALONE**?
- **F** Do you ever **FORGET** things you did while using alcohol or drugs?
- **F** Do your family or **FRIENDS** ever tell you that you should cut down on your drinking or drug use?
- **T** Have you gotten into **TROUBLE** while you were using alcohol or drugs?
I, ______________________, agree to not drink alcohol, use drugs, or take anyone else’s medication for the next _____ days. I also will not provide drugs, alcohol, or prescription medications for anyone else during this time. In addition, I agree to not drive a motor vehicle while under the influence of drugs or alcohol, nor will I ride with a driver who has been drinking or using drugs. I will come to my follow-up appointment with _____________ on ___________.
Signed, ______________________

Date: ______________________

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(DELIVERY COMMITTEE ON SUBSTANCE ABUSE, COMMITTEE ON ADOLESCENCE - Pediatrics March 2015, 135 (3) 584-587; DOI: https://doi.org/10.1542/peds.2014-4146)
MARIJUANA USE AND DRIVING DON’T MIX.

It increases the risk of being in a car crash.

1) AAP: Role Play Simulations for Clinical Training- interactive role-play simulations where health professionals build and assess their skills to have real-life conversation with adolescent patients about substance use and/or mental health concerns.
   - website;  [https://aap.kognito.com/](https://aap.kognito.com/)

2) Committee on Substance Abuse Pediatrics 2011;128:e1330-e1340

3) COMMITTEE ON SUBSTANCE ABUSE, COMMITTEE ON ADOLESCENCE
   Pediatrics March 2015, 135 (3) 584-587; DOI: https://doi.org/10.1542/peds.2014-4146

4) National institute on Drug Abuse:  [https://www.drugabuse.gov/](https://www.drugabuse.gov/)

5) Lara Marijuana Regulatory Agency ;  [https://www.michigan.gov/mra](https://www.michigan.gov/mra)
5) Monitoring the Future: a continuing study of American Youth, 
http://monitoringthefuture.org/data/data.html

6) The Impact of Marijuana Policies on Youth: Clinical, Research, and Legal Update
COMMITTEE ON SUBSTANCE ABUSE, COMMITTEE ON ADOLESCENCE Pediatrics March 2015, 135 (3) 584-587;
DOI: https://doi.org/10.1542/peds.2014-4146

7) Smart Approaches to Marijuana - SAM website: www.learnaboutsam.org

8) Substance Abuse and Mental Health Services Administration, http://www.samhsa.gov
