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Governance Brief

The Impact of Marijuana Legalization on K-12

The Effect of Marijuana on the Brain

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Introduction

The first of three briefs in CSBA's series on the effects of the legalization of marijuana on K-12 schools¹ reviewed how the decriminalization of marijuana for adult use under Proposition 64, the Adult Use of Marijuana Act of 2016,² has impacted school policy and student and staff access to marijuana products. The second brief reviewed the Compassionate Use Act (Proposition 215) of 1996³ and how it impacts the use of medical marijuana for students and staff on campus.

This final brief provides information about the harmful and helpful aspects of marijuana use and exposure for youth. The goal is to offer some basic facts and current research that will help school district and county office of education boards and their communities make intelligent and effective decisions about policy approaches, community partnerships, resource allocation, and educational programs.

What is Marijuana?

Marijuana is a species of plant that has many varieties and chemical variants. The two varieties most commonly used and cultivated for recreational and medicinal use are the Cannabis Sativa and the Cannabis Indica plants. Both are green, leafy plants that produce flowers and seeds that are dried and used to produce what we know as marijuana. Marijuana can be smoked like tobacco, inhaled as a vapor, brewed in tea, mixed into food, or extracted as oil and applied directly to the tongue or skin. What is unique about these two varieties of cannabis plants is the complex range of over 500 chemicals that they contain and that can be extracted for a variety of uses from different parts of the buds or flowers.

THC

The main chemical associated with marijuana's high is called Tetrahydrocannabinol, or THC. THC is derived from the resin of the female plant's leaves and buds. Depending on the

In this brief you will find:

- » Definitions of the difference between medical marijuana and medicinal marijuana.
- » The latest brain research on the effects of short- and long-term use of recreational marijuana and the adolescent brain
- » What we know about the effects of second-hand marijuana smoke on children and infants.

concentration of THC in a dosage of marijuana and whether it is smoked, inhaled or eaten, the psychoactive effects can be immediate or delayed, short or longer lasting. Over 100 additional chemical compounds related to THC can be produced by the plant. These are called Cannabinoids.⁴

CBD

The most commonly used compound of the marijuana plant is Cannabidiol, or CBD. CBD and THC work together to activate neurons in the brain in ways that have been shown to be both helpful for relief of medical conditions and stimulating in psychoactive ways. For medical purposes, CBD is typically used in higher concentrations than THC. In some cases, the THC in medical marijuana is negligible. For recreational purposes, however, THC levels can be much higher, causing physical and psychological effects such as euphoria, lack of coordination, disorientation, paranoia, and hunger. CBD can also be derived from the hemp plant, another member of the cannabis family. Hemp, unlike Cannabis Sativa or Indica, is not regulated by the

California Department of Public Health (CDPH), but by the California Department of Food and Agriculture (CDFA). A 2014 Farm Bill⁵ under President Obama allowed for the cultivation of industrial hemp for research purposes only. This led to some confusion among producers of industrial hemp CBD product manufacturers. The later legalization of marijuana in California led to further confusion. CBD oils and products from hemp are still popular items in the marketplace but are technically illegal. The extent to which local law enforcement is choosing to crack down on these sales varies across the state. You may continue to see cannabis massage oils, cannabis-infused beverages, or even pet products with CBD to help calm an anxious pet. These are considered illegal CBD food products unless they are produced with a proper license.⁶

Health Risks of Recreational Use

What does the current research say about the effects of marijuana consumption on our health? And what do we know about the health effects on youth? As we discussed in the previous two briefs in this series, medicinal marijuana continues

to be studied as a treatment for a variety of health issues, from chronic pain to seizure disorders, anorexia, and even as a means for curing opioid addiction. The concentration of THC in medicinal products, however, is generally very low and in some cases nonexistent. Nonetheless, THC is used to treat some of the same conditions as CBD in medical marijuana. The risk of occasional recreational use of marijuana for adults where THC is found at higher levels is a different question and a matter of continued debate and research.

The research on the effects of heavy, long-term use as well as use that begins in adolescence, however, is substantial, indicating that:

1. Critical regions of the brain that control memory, reasoning, judgment, and coordination develop during adolescence.
2. THC activates a part of the brain called the Endocannabinoid (EC) system.
3. The presence of THC in the EC system overwhelms the flow of neurons that send messages all over the body

Table 1: Recreational Marijuana Use: Short and Long-Term Effects

Short-Term, Occasional Use	Long-Term Use Beginning in Adolescence
<p>Impaired short-term memory: The part of the brain that controls memory is connected to the EC system. Introduction of THC into these neural pathways disrupts memory of recent events.</p>	<p>Addiction:</p> <ul style="list-style-type: none"> » 16 percent of teenagers who experiment with marijuana will become addicted to it. » Of those who become daily users, 25–50 percent will become addicted to marijuana and potentially other drugs or alcohol. » Teenage users of marijuana are two to four times more likely to become addicted than adult users.
<p>Impaired coordination: The part of the brain that perceives spatial relationships and body awareness is connected to the EC system and is disrupted. Car accidents occur in high numbers by those who drive after consuming marijuana.</p>	<p>Altered brain development:</p> <ul style="list-style-type: none"> » Adults who used marijuana regularly in adolescence show reduced neural connectivity in the brain in the prefrontal cortex and hippocampus. These regions control executive function, memory, and learning.
<p>Altered judgment: The part of the brain that controls executive function or impulse control is connected to the EC system. THC can disrupt this connection, causing impulsive behavior, including risky sexual behavior.</p>	<p>Cognitive impairment and lowered IQ:</p> <ul style="list-style-type: none"> » Poor educational outcomes with increased likelihood of dropping out of school » Impact on brain development described above is seen as a likely reason for this result.
<p>Paranoia and psychosis: High doses of THC have been shown to cause extreme psychotic episodes in some users.</p>	<p>Diminished life satisfaction and achievement:</p> <ul style="list-style-type: none"> » Surveys of adult, long-term marijuana users (who began using in adolescence) found them to be less satisfied with their achievement of life goals compared to nonusers.

and control movement, perception, memory, and in some cases, emotion.⁷ Introducing THC during a critical period in the brain's development (e.g., adolescence) alters the brain's ability to establish important connections to these systems in the brain.

4. Early and regular use of marijuana in adolescence can lead to addiction, use of other illicit drugs, and mood disorders.⁸

A National Institute of Health (NIH) peer-reviewed study examining the current research landscape found the strongest evidence, across multiple studies, for the short- and long-term effects of marijuana use as outlined in Table 1.⁹

Other Exposure that Affects Children and Youth

Research is still emerging regarding the effects of second-hand marijuana smoke as well as fetal exposure, but it is currently known that:

1. Use of marijuana by parents with children in the home is increasing¹⁰

A 2015 study of trends in tobacco and marijuana use by parents with children at home showed that between 2002 and 2015 tobacco use declined by 8 percent in parents with children at home while smoking cannabis increased by 2 percent. The same study found:

- » The highest percentage of marijuana smokers were young parents (age 18–25) who are also cigarette smokers.
- » Cigarette smokers were significantly more likely (almost four times) to be marijuana smokers.
- » Low-income communities had the highest percentage of marijuana smokers in the household.¹¹

2. Second-hand cannabis smoke exposure has negative effects¹²

Another NIH review of recent research on the effects of second- and third-hand marijuana smoke exposure found strong evidence that:

- » Exposure in non-ventilated rooms or automobiles to second-hand marijuana smoke produces mild psychoactive effects.
- » THC levels are detectable in oral and urine tests given to passive inhalers.

3. Pregnant and breast-feeding mothers using marijuana are exposing infants to THC¹³

- » Fetal exposure to THC is in the early stages of research, but some researchers believe that what is known about the Endocannabinoid system and its early development in utero is definitive. Some see fetal exposure to THC as an early assault on a system that controls multiple functions in human development resulting in unknown, negative consequences. At least one study has identified a specific gene expression (D (2) mRNA) that is affected by maternal use of marijuana during pregnancy. This gene expression impacts the neural systems that regulate emotional behavior.¹⁴
- » Research indicates that even mothers who are regular marijuana users who abstain from use during pregnancy should be aware of the effects of resumed use if they are breast-feeding a newborn. Studies have shown that low-levels of THC from inhaled marijuana are detectable in breast milk.¹⁵

Research Limitations

It should be noted that there are several factors that hinder researchers' full understanding of the long-term effects of marijuana use and will require further study and attention:

1. It is difficult to separate the effects of marijuana use from other drug effects in subjects who use marijuana along with other narcotics. Therefore, long-term effects may vary depending on what else someone was consuming, at what levels, and at what period of their growth and development. This holds true for in-utero studies as well.
2. THC levels in marijuana have been steadily rising over the course of approximately 30 years of research. Marijuana samples taken in the 1980s averaged 3 percent THC and in 2012 averaged 12 percent, so older research should be viewed with this in mind. This increase is also seen as a possible explanation for a current rise in car accidents and emergency room visits associated with marijuana use.¹⁶

Implications for School Boards

How can school boards support school districts and county offices of education in their communities as they roll out their education programs for students, teachers, parents, and community members? If we know that children's emotional and behavioral health is impacted either directly or indirectly by exposure to marijuana from a very young age, any approach must touch the parents of the very youngest children, elementary schools, as well as middle and high

schools. This is not just a teenage problem. Partnerships between schools, districts, counties, cities, and community groups are beginning to emerge across California to tackle this task. Following are some examples of these partnerships.

Partnerships for Public Information

The California Department of Public Health (CDPH) launched a public information campaign in 2016 called “Let’s Talk Cannabis”¹⁷ that provides a comprehensive set of resources and tools for communities to provide accurate information and educational materials about marijuana. This includes social media resources, community tool kits, and information for parents and teens. County Health Departments such as in Butte¹⁸ and Los Angeles counties¹⁹ have partnered with CDPH to create their own websites and customized resources for their communities.

Recently, the city of Pasadena launched a health education campaign about marijuana, called “Smoke is No Joke,” which posts educational information on city buses.²⁰ It was created with input from several local youth organizations and Rose City High School students.

Examples from Other States

States that legalized recreational marijuana before California have launched and evaluated a variety of public information campaigns. They have also utilized partnerships between community groups and local governments, such as Vancouver, Washington’s “Weed Can Wait Campaign,”²¹ which focuses on encouraging teens to wait until they are adults before using marijuana.

The city and county of Denver, Colorado, launched a campaign in 2016 called “The High Costs”²² aimed at educating the city’s and county’s youth about the risks of under-age marijuana use.

Oregon’s “Stay True to You”²³ campaign, sponsored by the Oregon Health Authority, targets youth ages 12 to 20. It uses social media and a series of compelling videos based on school surveys conducted every two years to talk about youth attitudes and experiences with marijuana and how to make healthy decisions.

Early evaluations in Colorado and Oregon have shown encouraging results about the impact of their information campaigns, but there are still questions about whether all audiences are being reached. Colorado’s “Good to Know” program, targeting adults 21 and older, was shown to raise awareness and lower the chances of first-time use. It did not, however, have significant impact on those who were already marijuana consumers. The “High Costs” campaign (referenced above),

targeting those under 21, has been criticized for using scare tactics rather than focusing on healthy decisions and harm reduction. Students for Sensible Drug Policy (SSDP),²⁴ an international, student-run nonprofit action group offers this advice:

“Any public awareness campaign about drugs needs to educate both people who intend to abstain from drug use and those who intend to engage in drug use. Failing to address the needs of both populations reduces what would be an educational program to prevention propaganda. Programs like D.A.R.E., Just Say No, and Scared Straight all told students to just not do drugs. D.A.R.E., Just Say No, and Scared Straight were ineffective at reducing drug use, and completely failed at preparing young people for a reality where people use drugs. Our ideal drug education informs about ways of reducing harm associated with drug use and the potential consequences associated with using drugs. It contains factual information about the drugs themselves, harm reduction tips, information about routes of administration and dosing, information on poly-substance use and what combinations are least or most harmful, information on the legal status of a drug and the laws around it, and more. Proper drug education also needs to be non-stigmatizing and non-judgmental in its approach.” (Colorado Cannabis Campaigns: What Works, What Doesn’t and What We’d Like to See. February 5, 2018)²⁵

Frequently Asked Questions

Question: My district is reporting increased 911 calls for students who have ingested marijuana. Why is this happening?

Answer: Edible marijuana products typically contain more potent levels of THC than other forms and students are unaware of this. The effects can be delayed by 30 minutes or more and can cause disorientation, paranoia, and in some cases, loss of consciousness. This means that a student who is given edible marijuana at lunchtime by a friend who brought it from home may feel fine at first, but a class period or two later will be in distress.

Question: Are the negative effects of marijuana use on the brain permanent?

Answer: Longitudinal studies of negative effects from marijuana use show the most sustained effects in those who are regular (daily) users and who began use during adolescence. Permanent effects have not been shown in occasional users.

Question: Is CBD approved by the FDA?

Answer: A new drug called Epidiolex, which contains a synthetic form of CBD was approved by the FDA in June 2018.²⁶ Pharmaceutical companies will likely continue to develop and test similar drugs for FDA approval, thus simplifying questions of legality for schools in the future.

Resources

Centers for Disease Control (CDC) Fact Sheets:

Marijuana and Driving: www.cdc.gov/marijuana/factsheets/driving.htm

Marijuana and Pregnancy: www.cdc.gov/marijuana/factsheets/pregnancy.htm

Marijuana Use and Teens: www.cdc.gov/marijuana/factsheets/teens.htm

National Institute for Drug Abuse (NIDA) Fact Sheets:

For parents: teens.drugabuse.gov/parents

For teens: teens.drugabuse.gov/videos

For teachers: teens.drugabuse.gov/teachers

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Endnotes

- 1 CSBA Marijuana Policy Briefs: www.csba.org/GovernanceAndPolicyResources/ResearchAndPolicyBriefs
- 2 Adult Medical Use of Marijuana Act of 2016: leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB64
- 3 Compassionate Use Act of 1996: leginfo.ca.gov/faces/codes_displaySection.xhtml?sectionNum=11362.5.&lawCode=HSC
- 4 National Institute on Drug Abuse Definitions: www.drugabuse.gov/publications/research-reports/marijuana/what-marijuana
- 5 See the 2014 Federal Farm Bill: nifa.usda.gov/industrial-hemp
- 6 California Department of Public Health Policy on Industrial Hemp: www.cdph.ca.gov/Programs/CEH/DFDCS/CDPH%20Document%20Library/FDB/FoodSafetyProgram/HEMP/Web%20template%20for%20FSS%20Rounded%20-%20Final.pdf
- 7 The Science of the Endocannabinoid System: How THC Affects the Brain and Body; Scholastic Education Information for Students: headsup.scholastic.com/students/endocannabinoid
- 8 Hall, W. & Degenhardt, L. (2007). Prevalence and Correlates of Cannabis Use in Developed and Developing Countries. www.ncbi.nlm.nih.gov/pubmed/17551355/ and Chen, CY, Storr, CL & Anthony, JC. (2009) Early on-set Drug Use and Risk for Drug Dependence Problems: www.ncbi.nlm.nih.gov/pubmed/19022584/
- 9 Volkow, Nora, Baler, Ruben et al. (2014). Adverse Health Effects of Marijuana Use. www.ncbi.nlm.nih.gov/pmc/articles/PMC4827335/
- 10 It is important to note that marijuana in this definition is recreational and therefore contains higher THC levels.
- 11 Goodwin, Renne, Cheslack-Postava, Keely, et al. (2015). Trends in Cannabis and Cigarette Use Among Parent with Children at Home from 2002 to 2015: pediatrics.aappublications.org/content/early/2018/05/10/peds.2017-3506
- 12 Holitzki, H., Dowsett, L.E., et al. (2017). Health Effects of Exposure to Second- and Third-Hand marijuana smoke; A Systemic Review: www.ncbi.nlm.nih.gov/pubmed/29192095
- 13 Richardson, K.A., Hester, A.K., Mc Lemoire, G.L. (2016). Prenatal Cannabis Exposure- 'The first hit' on the Endocannabinoid System. www.ncbi.nlm.nih.gov/pubmed/27567698
- 14 Wang, X., Dow-Edwards, D. et al. (2004). In Utero Marijuana Exposure Associated with Abnormal Amygdala Dopamine D2 Gene Expression in Human Fetus: www.ncbi.nlm.nih.gov/pubmed/15601599
- 15 Baker, T., Datta, P., et al, (2018). Transfer of Inhaled Cannabis into Human Breast Milk. www.ncbi.nlm.nih.gov/pubmed/29630019
- 16 Volkow, Nora, Baler, Ruben et al. (2014). Adverse Health Effects of Marijuana Use: www.ncbi.nlm.nih.gov/pmc/articles/PMC4827335/
- 17 CDPH Let's Talk Cannabis Campaign: www.cdph.ca.gov/Programs/DO/letstalkcannabis/Pages/LetsTalkCannabis.aspx
- 18 Butte County Campaign: www.buttecounty.net/publichealth/Programs/LetsTalkCannabis
- 19 Los Angeles County Campaign: publichealth.lacounty.gov/sapC/teens/
- 20 Pasadena Campaign: ww5.cityofpasadena.net/city-manager/2018/05/07/4419/
- 21 Vancouver Campaign: www.esd112.org/news/vancouver-youth-and-community-leaders-behind-the-420-launch-of-weed-can-wait-campaign/
- 22 Denver Campaign: www.thehighcosts.com
- 23 Oregon Campaign: www.staytruetoou.org/#home
- 24 Students for Sensible Drug Policy: ssdp.org/about/
- 25 Students for Sensible Drug Policy Campaign Reviews: ssdp.org/blog/colorado-cannabis-education-campaigns-works-doesnt-wed-like-see/
- 26 FDA News Release: www.fda.gov/newsevents/newsroom/press-announcements/ucm611046.htm