

# Why THC Limits are Misguided & Harmful

## Executive Summary

The misguided efforts by state lawmakers to limit the amount of THC in cannabis products are becoming increasingly popular across the country. THC caps, favored by legalization opponents under the guise of protecting public health and safety, would be detrimental to medical cannabis patients, consumers, and the legal cannabis industry. Furthermore, a ban on high-THC cannabis would operate as an extension of the unsuccessful and racially disparate criminalization of cannabis in the United States. THC caps would restrict access to safe, legal cannabis for patients, drive cannabis sales to unregulated or out-of-state markets, worsen the quality of cannabis concentrates, and harm small cannabis businesses.

### THC and THC Caps, Explained

THC, or tetrahydrocannabinol, is a cannabinoid found in the cannabis plant that is primarily responsible for cannabis's psychoactive and therapeutic effects. A THC cap, or a potency cap, is an upper limit on the amount of THC that can be present in cannabis or cannabis products sold to consumers.

### Why THC Caps Are Harmful

Limiting the amount of THC in cannabis and cannabis products would hurt patients, consumers, and the cannabis industry while doing little-to-nothing to protect public health and safety.

THC caps are arbitrary and not formulated on science

THC caps are inadvisable because 1) THC is not the sole indicator of intoxication, 2) studies show that THC impacts individuals differently, and 3) there is evidence that higher THC products do not necessarily result in an individual feeling "higher."

THC caps would harm patients and threaten access to safe, legal cannabis

THC caps would prevent certain patients from accessing the higher-THC cannabis required to meet their needs, force some patients to turn to unregulated sources or resort back to their prescription medications, and would disproportionately harm low-income patients.

Consumers would turn to the unlicensed market or travel to nearby states without THC caps

A THC cap would not eliminate the demand for high-THC products, but instead would push consumers to seek out these products from other sources. Consumers would either turn to the well-established unlicensed market, where products are unregulated and untaxed, or neighboring states without potency caps.

THC caps would be bad for the cannabis industry

Limiting the amount of THC in cannabis products would be harmful to the legal industry by (1) putting licensed operators at a major competitive disadvantage with out-of-state and unregulated markets, (2) forcing manufacturers to use larger quantities of additives in cannabis concentrates, and (3) making it significantly more difficult for small manufacturers and craft growers to compete with large cannabis operators.

### Policy Recommendations

- Require cannabis products to include warning labels and information on cannabinoid content.
- Adopt reasonable package and serving size limitations for cannabis edibles.
- Allow cannabis businesses to reasonably brand and market their products.
- Use cannabis tax revenue to fund healthcare programs, research, and educational campaigns.

## THC Caps, Explained

A THC cap, or a potency cap, is an upper limit on the amount of THC that can be present in cannabis or cannabis products sold to consumers. For example, recent legislation in Florida attempted to impose a 10% THC limit on all cannabis flower and a 60% THC limit on all concentrates.

<sup>1</sup> Facing significant backlash from patients, veterans, doctors, and the industry, the effort to cap THC in Florida was ultimately unsuccessful. Additional attempts to limit THC have recently been made in Colorado, Washington, Montana, and Massachusetts, but none have yet been successful.<sup>2</sup> Potency caps currently exist in states with highly restrictive medical cannabis programs, such as Texas, where medical cannabis products cannot exceed 1% THC. Vermont and Connecticut are the only adult-use states with THC caps. In both states, cannabis flower is limited to 30% THC, and concentrates cannot exceed 60% THC. Proponents of potency caps believe that restricting the amount of THC in cannabis and cannabis products will minimize the potentially harmful effects associated with the consumption of high-THC cannabis.

## What is THC?

THC, or tetrahydrocannabinol, is a cannabinoid found in the cannabis plant that is primarily responsible for cannabis's psychoactive and therapeutic effects. A cannabinoid is a chemical compound produced by many biological species, from plants to mammals. Kale, Brussels sprouts, carrots, and even humans naturally produce their own cannabinoids.<sup>3,4</sup> Cannabinoids interact with the body's endocannabinoid system, which is a system of cannabinoid receptors that "[regulate and control] many of our most critical bodily functions such as learning and memory, emotional processing, sleep, temperature control, pain control, inflammatory and immune responses, and eating."<sup>5</sup> There are over 100 known cannabinoids found in the cannabis plant, with THC and cannabidiol, or CBD, being the most well-known.

THC is often used as a shorthand for delta-9-tetrahydrocannabinol (delta-9 THC). However, there are several chemical analogs of THC, including delta-8 THC, delta-10 THC, THC-a, THCP, 11-hydroxy-THC, and THCV. Though delta-9 THC is not the only psychoactive compound found in cannabis, it is regarded as the *primary* psychoactive cannabinoid. Most states with legal medical or adult-use cannabis define "THC" to mean solely delta-9 THC, but there are some states, such as Nevada, that define THC as both delta-9 THC and delta-8 THC.

### Common THC Analogs

**Delta-9 THC:** Delta-9 THC is the most common THC analog and is largely responsible for the psychoactive and therapeutic effects associated with cannabis consumption. While it is important to note that delta-9 THC is not the only psychoactive cannabinoid, it is the main psychoactive component found in cannabis.

**Delta-8 THC:** Delta-8 THC is an isomer of Delta-9 THC, or a degraded form of Delta-9 THC. Delta-8 THC occurs naturally in cannabis in very small quantities, or CBD can be converted into Delta-8 THC through a chemical process known as isomerization. Delta-8 THC and Delta-9 THC have nearly-identical molecular structures, but there are key differences in how each cannabinoid impacts the body. Delta-8 THC has psychoactive effects, but to a lesser degree than Delta-9 THC.

**Delta-10 THC:** Delta-10 THC is a naturally occurring cannabinoid that interacts with the body's endocannabinoid system in a similar manner as Delta-9 THC and Delta-8 THC. Though Delta-10 THC occurs in small quantities in cannabis, the majority of Delta-10 products come from hemp-derived CBD. Delta-10 THC is known to be psychoactive, but there is limited research on its effect on the body.

**For the remainder of this paper, “THC” refers to delta-9 THC, unless otherwise specified.**

## Medical benefits of THC

Cannabis is widely recognized for its medical value in treating or easing the symptoms of a number of serious medical conditions. According to Americans For Safe Access’ 2020 State of the States Report, there are an estimated 4.4 million current medical cannabis users in the United States and over 100 qualifying conditions in state medical cannabis programs.<sup>6</sup> As of August 2021, thirty-six states have legalized cannabis for medical use, and eleven states have legalized CBD or low-THC medical cannabis. Only two states- Idaho and Nebraska- have not legalized some form of medical cannabis.<sup>7</sup>

THC is the main cannabinoid associated with the therapeutic benefits of cannabis. Multiple studies have demonstrated THC’s efficacy in treating nausea, chronic pain, PTSD, multiple sclerosis, HIV/AIDS-related symptoms, and more.<sup>8</sup> Though cannabis remains illegal at the federal level in the United States, the FDA has approved two drug products, Marinol and Syndros, that contain dronabinol, a synthetic delta-9 THC. According to the FDA, both Marinol and Syndros are “used to treat nausea associated with cancer chemotherapy and for the treatment of anorexia associated with weight loss in AIDS patients.”<sup>9</sup>

## How much THC is in cannabis?

The amount of THC in cannabis, often referred to as a product’s “potency,” is typically expressed as the number of milligrams per serving or as a percentage. Total THC varies based on several factors, including product type, strain, and how the cannabis is grown. Cannabis flower typically ranges from 10% to 25% THC, but certain strains can exceed 30% THC. Cannabis concentrates contain much higher percentages of THC, often ranging from 60% to 90% depending on the method of concentration. For example, the average THC percentage for flower sold in Colorado in 2019 was 18.8%, and the average THC for concentrates was 69.4%.<sup>10</sup>

There is evidence that, over time, the average amount of THC found in cannabis has steadily increased. A recent study found that the concentrations of delta-9 THC across international markets have increased significantly between 1970 and 2017. The average THC for flower and resin increased approximately .29% and .57% each year, respectively.<sup>11</sup> This rise in the average THC in cannabis can likely be attributed to an increase in demand for higher THC cannabis and improvements in cultivation and manufacturing technology.

## Why THC Caps Are Harmful

Limiting the amount of THC in cannabis and cannabis products would hurt patients, consumers, and the industry while doing little-to-nothing to protect public health and safety. THC caps are misguided and harmful because:

- THC caps are arbitrary and not formulated on science;
- THC caps would harm patients and threaten access to safe, legal cannabis;
- Consumers would seek out higher potency products from the unlicensed market or travel to nearby states without THC caps;
- THC caps would be detrimental to the regulated cannabis industry.

## THC caps are arbitrary and not formulated on science

THC caps are inadvisable policy because 1) THC is not the sole indicator of intoxication, 2) THC impacts individuals differently, and 3) there is evidence that higher THC products do not necessarily result in an individual feeling “higher.”

THC is not the sole indicator of intoxication

THC is not the only compound in cannabis that impacts an individual’s impairment levels, therefore THC caps are an erroneous approach to discouraging intoxication. While delta-9 THC is the primary cannabinoid associated

with the psychoactive effects of cannabis, there are numerous other compounds in the plant that affect how “high” a person feels. When multiple compounds in cannabis interact, their effects may be altered or enhanced. This is known as the **entourage effect**.<sup>12</sup> A study published in the British Journal of Pharmacology found supporting evidence that the addition of certain cannabinoids and terpenes (aromatic compounds found in plants, including cannabis) may “strengthen and broaden clinical applications and improve the therapeutic index of cannabis extracts containing THC.”<sup>13</sup> While more research is needed on the entourage effect and how different cannabis compounds interact, focusing entirely on THC to curb intoxication is an unscientific, arbitrary approach to regulating cannabis.

### THC impacts individuals differently

Cannabis affects individuals differently, making THC caps a fundamentally flawed method of preventing overconsumption and intoxication. Depending on a number of factors, including one’s genetics, past cannabis use, and product and strain type, the effects of THC consumption will vary from person to person. A 2020 study examining how cannabis impacts an individual’s ability to drive concluded that there is a “poor and inconsistent relationship between magnitude of impairment and THC concentrations in biological samples.”<sup>14</sup> Participants in this study displayed different impairment levels during a driving simulation, despite consuming the same amount of cannabis beforehand. This study demonstrates that the same cannabis product with the same THC concentration will impact individuals differently.

Dr. Staci Gruber, the director of the Marijuana Investigations for Neuroscientific Discovery programs at McLean Hospital, told the Boston Globe, “it’s already clear that it’s not just about what and how much [cannabis] you’re using, it’s about how you’re wired.”<sup>15</sup> Where a cannabis product with 10% THC might be the optimal treatment for one patient, it may be too much, or not enough, for someone else.

### Higher THC doesn’t necessarily mean “higher”

Emerging evidence shows that higher THC products do not necessarily equate to greater levels of impairment. A recent study from the University of Colorado Boulder had participants consume either high-THC concentrates (70% to 90% THC) or lower THC flower (16% -24% THC) and were assessed after.<sup>16</sup> The researchers found that, despite both groups consuming vastly different levels of THC, “short-term subjective and neurobehavioral impairments did not track specifically with strength of the cannabis consumed.” While higher THC levels in cannabis may be associated with greater relief or medical benefit, THC content is not necessarily a reliable indicator of individual intoxication.

### THC caps would harm patients and threaten access to safe, legal cannabis

THC caps would harm patients who rely on cannabis to treat various debilitating medical conditions by: (1) preventing certain patients from accessing the higher-THC products required to meet their needs, (2) forcing some patients to purchase cannabis from the unregulated cannabis market or resort back to their prescription medications, and (3) disproportionately impacting low-income patients and putting them at risk of losing access to their medicine. **Medical patients, under the guidance of their recommending practitioner, should be given the freedom to choose the cannabis products most suitable to treat their individual medical needs.**

Certain patients rely on high-THC cannabis, and a potency cap would take away their medicine

A reactionary ban on higher THC products runs the risk of preventing some patients from accessing the products needed to treat their specific condition. Because THC impacts individuals differently, higher THC products may be necessary to meet the needs of certain patients. A growing body of evidence shows that higher levels of THC may be associated with higher levels of pain relief. According to a 2019 study examining self-reported data of the pain levels of medical patients before and after using cannabis, “only higher THC levels were independently associated with greater symptom relief.”<sup>17</sup> A separate study examining the pain relief effect of THC at different doses for patients experiencing cancer-related pain found that the level of relief was “significantly superior” to

the placebo at higher dose levels (15mg and 20mg of THC).<sup>18</sup> Another study found that a majority of patients surveyed who used cannabis to treat migraines preferred a high-THC cannabis strain.<sup>19</sup> While more research is needed, these studies help demonstrate how higher THC cannabis can be more suitable for certain medical conditions.

A THC cap would push patients to the unregulated market or back to prescription medications. A THC cap coupled with strict possession limits would either push consumers to purchase additional cannabis from unregulated sources or, in some cases, result in patients supplementing with prescription medications to sufficiently treat their condition. For example, cannabis has been demonstrated to reduce or entirely replace opioids for some patients. In states with a possession limit, such as Oregon and Vermont, where consumers can possess up to 1 ounce of cannabis, a THC cap could entirely prevent patients from legally acquiring the amount of THC necessary to address their medical needs. Restricting access to high-THC cannabis products may force some individuals to turn back to their prescriptions or purchase cannabis from the unregulated market.

Low-income patients would be disproportionately harmed

A THC cap would be detrimental to low-income patients who would need to buy more cannabis products to achieve the same results as their current preferred products. Medical cannabis is not covered by insurance in the United States, meaning that many patients have to pay hundreds of dollars each month for their medicine. Restricting the amount of THC in cannabis would exacerbate these costs for patients and would result in some individuals no longer being able to afford their medicine.

### Consumers would seek out higher potency products from the unlicensed market or travel to nearby states without THC caps

A THC cap would not eliminate the demand for high-THC cannabis products but instead would push consumers to seek out these products from other sources. Consumers would either turn to the well-established unlicensed market, where products are often cheaper, or to neighboring states without potency caps. Potency caps would only serve to bolster the unlicensed market, drive cannabis sales to nearby states, and divert potential tax revenue.

THC caps would bolster the unregulated market

Consumers faced with a THC cap would seek higher potency cannabis from the unregulated market. Products purchased from unregulated sources have likely not undergone the rigorous lab testing required of regulated products. Laboratory testing standards vary from state to state, but cannabis is typically tested for cannabinoid content, residual solvents, contaminants, heavy metals, and pesticides. Laboratory testing is crucial to ensure that cannabis is safe for consumption and to provide consumers with information on the potency and cannabinoid content of the products they purchase.

THC caps would drive consumption to out-of-state markets

A THC cap would result in consumers purchasing higher potency products from neighboring states without potency limits, resulting in diminished sales for the legal industry and a significant loss of tax revenue. Consumers in states with restrictive markets already travel out of state to purchase cheaper cannabis, as is the case with Arkansas residents traveling to Oklahoma, therefore it is not unreasonable to assume that consumers would do the same if a potency cap were implemented.<sup>20</sup>

### THC caps would be detrimental to the regulated cannabis industry

Limiting the amount of THC in cannabis products would be harmful to the legal industry by (1) putting licensed operators at a major competitive disadvantage with out-of-state and unregulated markets, (2) forcing

manufacturers to use larger quantities of additives in cannabis concentrates, and (3) making it significantly more difficult for small and craft growers to compete with large cannabis operators.

#### Short- and long-term consequences of THC caps

A THC cap would have negative short-term and long-term implications for a state's cannabis industry. In the short-term, legal cannabis operators would be at a significant competitive disadvantage with the unlicensed market. Consumers seeking high-THC products would revert back to, or continue purchasing from, unregulated sources. To successfully eliminate the unregulated cannabis market, legal operators must be given the ability to compete on price, quality, and convenience. A THC cap would make viability in the legal industry exceedingly difficult for licensed operators. In the long-term, cannabis products grown and processed in a state with a restrictive potency cap would be significantly less competitive in a federal regulatory framework that permits interstate commerce, as consumers would simply seek out-of-state products with higher THC levels.

#### Manufacturers would be forced to use larger amounts of fillers in concentrates

A THC cap would be especially detrimental to the quality of cannabis concentrates, which many patients rely on for quick pain relief. Cannabis concentrates are products derived from the cannabis plant and processed into a concentrated form. Concentrates are made by recovering desirable compounds, such as cannabinoids or terpenes, from plant materials through mechanical or chemical means. Certain cannabis concentrates, such as oils consumed using a vaporizer, allow an individual to consume small, yet potent, amounts of cannabis quickly. These products typically take effect within minutes, making them a favorable option for patients experiencing chronic or intractable pain. In addition to the fast-acting nature of some concentrates, many patients and adult-use consumers are drawn to these products because they contain high amounts of cannabinoids without excess plant material.

A THC cap would require manufacturers to use larger quantities of additives in cannabis concentrates to ensure their products are compliant. Many concentrate products use small amounts of fillers, such as coconut oil, propylene glycol, medium-chain triglycerides (MCTs), and fragrances, to achieve a desired consistency, taste, or experience for the consumer. Limiting the amount of THC in concentrates would unnecessarily force a greater reliance on these additives.

#### Microbusinesses and craft growers would be harmed

Microbusinesses and craft cannabis growers whose main competitive advantage is the potency and quality of their cannabis products would fare much worse with the implementation of a THC cap than large, multi-state operators. A THC cap would make the cannabis industry overall less competitive with less product diversity.

## Policy Recommendations

THC caps are harmful and **should be avoided entirely**. Going further, to protect consumers, encourage responsible and safe consumption, and address the concerns about the potential impact of high-potency cannabis products, the following policy recommendations should be considered:

### Require all cannabis products to include proper warning labels and information on cannabinoid content

To promote consumer safety and education, cannabis products should be required to include reasonable warning labels and information on cannabinoid content. The intent of warning labels should be to inform consumers about the potential intoxicating effects and health risks of cannabis, as well as caution against driving or operating heavy machinery while under the influence. Warning labels should also include clear instructions to keep the product away from children. For example, California requires all cannabis concentrates to include the following warning:



“GOVERNMENT WARNING: THIS PRODUCT CONTAINS CANNABIS, A SCHEDULE I CONTROLLED SUBSTANCE. KEEP OUT OF REACH OF CHILDREN AND ANIMALS. CANNABIS PRODUCTS MAY ONLY BE POSSESSED OR CONSUMED BY PERSONS 21 YEARS OF AGE OR OLDER UNLESS THE PERSON IS A QUALIFIED PATIENT. THE INTOXICATING EFFECTS OF CANNABIS PRODUCTS MAY BE DELAYED UP TO TWO HOURS. CANNABIS USE WHILE PREGNANT OR BREASTFEEDING MAY BE HARMFUL. CONSUMPTION OF CANNABIS PRODUCTS IMPAIRS YOUR ABILITY TO DRIVE AND OPERATE MACHINERY. PLEASE USE EXTREME CAUTION.”

Labels should also include the major cannabinoids present in the cannabis product, along with the quantities listed as a percentage or in milligrams. At a minimum, the amount of THC and CBD should be included on the label.

### Adopt reasonable package and serving size limitations for cannabis edibles

Limits on the amount of THC in edibles are commonplace in medical and adult-use markets. For example, edibles in Colorado cannot exceed 10mg of THC per individual serving or 100mg of THC per package. Cannabis edibles differ from other cannabis products primarily in the way they are processed in the body. After consumption, the active compounds in an edible metabolize in the liver, converting delta-9 THC into 11-hydroxy-THC, a THC analog that is more potent and longer-lasting than delta-9 THC. Edibles also take longer than other cannabis products to take effect. The effects of smoked cannabis can be felt almost immediately, whereas edibles can take up to two hours to impact the body.

Because edibles are typically more potent, longer-lasting, and have a delayed impact, these reasonable THC limits and serving sizes help prevent individuals from consuming too much cannabis too quickly. However, THC limits should not fall below 100mg for a single edible product. Alaska recently increased the maximum THC limits in edibles from 5mg of THC per serving with a maximum of 50mg of THC per package to 10mg per serving and 100mg per package.<sup>21</sup>

#### Examples of statewide THC limits for edibles

State	Edible Serving Size THC Limit	Edible Package THC Limit
California	10mg	100mg
Colorado	10mg	100mg
Massachusetts	5.5mg	110mg

### Allow cannabis businesses to reasonably brand and market their products

Instead of harmful THC caps to discourage the consumption of high-potency cannabis, operators should be allowed to include information on potency and recommended dosage in the marketing and branding of their cannabis products. Advertising and branding play a critical role in supporting the licensed market and promoting consumer knowledge of safe, legal cannabis. If brands are limited to including only the cannabinoid content on their packaging and labeling, as is the case in Canada, consumers will likely conflate higher THC with higher quality. One study found that very few consumers are able to understand quantitative THC labeling (i.e. displaying the amount of THC in milligrams), whereas consumers are much more likely to understand THC content and recommended dosage if a product label included serving sizes and additional symbols to indicate potency (i.e. a traffic light system to signal ‘low’ vs. ‘high’ THC).<sup>22</sup> Allowing brands to include information about

a cannabis product's unique characteristics, intended effect, and suggested use on packaging, labeling, and advertising will guide consumers to make purchasing decisions based on several factors, not just THC content.

### Use cannabis tax revenue to fund healthcare programs, research, and educational campaigns

Potential negative externalities associated with the consumption of high-potency cannabis can be addressed with the allocation of tax revenue to healthcare programs, educational campaigns, and new research.

#### Funding for healthcare programs

The majority of states with legal adult-use cannabis allocate at least some cannabis revenue to health services or drug and alcohol treatment programs. For example, Oregon allocates 20% of all cannabis tax revenue to mental health services and alcohol and drug abuse treatment programs.<sup>23</sup> Though cannabis-related hospitalizations are rare, and adult-use legalization is associated with a decline in adolescent treatment admissions for cannabis, allocating tax revenue to healthcare and drug treatment programs can help address any potential adverse public health impacts related to cannabis.<sup>24</sup>

#### Educational campaigns

Educational campaigns can help inform consumers of the potential risks of cannabis and can encourage responsible, safe consumption. Colorado's *Good to Know* campaign provides an example of an educational program that was successful in educating the public on safe cannabis consumption and the potential adverse consequences of excessive use. Instead of taking a position in support or opposition of cannabis, the campaign instead focused on "educating the public on legal use and the health effects of marijuana."<sup>25</sup> This objective and non-judgmental approach proved successful, as residents familiar with the campaign were 2.5 times more likely to have knowledge of Colorado's cannabis laws. The campaign was also successful in increasing the public's perception of the risks and health impacts of impaired driving, excessive use, over-consumption of edibles, and leaving cannabis products in open containers in homes with children. Colorado's *Good to Know* campaign is evidence that publicly-funded educational programs can be successful in teaching consumers about the potential risks of cannabis and how to be a responsible, informed consumer.

#### Research

Tax revenue can also be used to fund much-needed research on the science of cannabis, the effect of cannabis and different cannabinoids on human health, and the social and economic impacts of legalization. For example, California awards \$10 million every year to public universities to research the public health, safety, economic and environmental impact of cannabis legalization.



## End Notes

- <sup>1</sup>Florida, House of Representatives. HB 1455 (2021) - Regulation of Medical Marijuana. *MyFloridaHouse.Gov*, Introduced 21 Feb. 2021, [www.myfloridahouse.gov/Sections/Bills/billsdetail.aspx?BillId=72700](http://www.myfloridahouse.gov/Sections/Bills/billsdetail.aspx?BillId=72700)
- <sup>2</sup>Demko, Paul, and Natalie Fertig. "The Cannabis Industry's next War: How Strong Should Its Weed Be?" *POLITICO*, POLITICO, 29 Apr. 2021, [www.politico.com/news/2021/04/29/cannabis-industry-next-war-485044](http://www.politico.com/news/2021/04/29/cannabis-industry-next-war-485044).
- <sup>3</sup>Gertsch, Jürg et al. "Phytocannabinoids beyond the Cannabis plant - do they exist?." *British journal of pharmacology* vol. 160,3 (2010): 523-9. doi:10.1111/j.1476-5381.2010.00745.x
- <sup>4</sup>Fride, Ester. "The Endocannabinoid-CB1 Receptor System in Pre- and Postnatal Life." *European Journal of Pharmacology*, Elsevier, 17 Aug. 2004, [www.sciencedirect.com/science/article/abs/pii/S0014299904007423](http://www.sciencedirect.com/science/article/abs/pii/S0014299904007423).
- <sup>5</sup>Grinspoon, Peter. "The Endocannabinoid System: Essential and Mysterious." *Harvard Health Publishing*, Harvard Medical School, 11 Aug. 2021, [www.health.harvard.edu/blog/the-endocannabinoid-system-essential-and-mysterious-202108112569](http://www.health.harvard.edu/blog/the-endocannabinoid-system-essential-and-mysterious-202108112569).
- <sup>6</sup>"2020 State of the States Report." *Americans for Safe Access*, Americans for Safe Access, 2020, [www.safeaccessnow.org/sos](http://www.safeaccessnow.org/sos).
- <sup>7</sup>While Kansas permits the use of CBD oil, any amount of THC is strictly prohibited in the state. This creates a de facto ban, as all CBD products contain at least trace amounts of THC.
- <sup>8</sup>"The Medical Value of Marijuana and Related Substances." *Marijuana and Medicine: Assessing the Science Base*, by Janet E. Joy et al., National Academy Press, 1999. <https://www.ncbi.nlm.nih.gov/books/NBK230711/>
- <sup>9</sup>"FDA and Cannabis: Research and Drug Approval Process." *U.S. Food and Drug Administration*, FDA, 1 Oct. 2020, [www.fda.gov/news-events/public-health-focus/fda-and-cannabis-research-and-drug-approval-process](http://www.fda.gov/news-events/public-health-focus/fda-and-cannabis-research-and-drug-approval-process).
- <sup>10</sup>MPG Consulting, and University of Colorado Boulder, Leeds School of Business. Colorado Department of Revenue, Marijuana Enforcement Division, 2019, *2019 Regulated Marijuana Market Update Report*, [www.colorado.gov/pacific/sites/default/files/2019%20Regulated%20Marijuana%20Market%20Update%20Report%20Final.pdf](http://www.colorado.gov/pacific/sites/default/files/2019%20Regulated%20Marijuana%20Market%20Update%20Report%20Final.pdf).
- <sup>11</sup>Freeman, Tom P. et al. "Changes in Delta-9-Tetrahydrocannabinol (Thc) and Cannabidiol (Cbd) Concentrations in Cannabis over Time: Systematic Review and Meta-Analysis." *Addiction*, vol. 116, no. 5, 2020, pp. 1000–1010., doi:10.1111/add.15253.
- <sup>12</sup>Ratliff, Sarah. "The Science behind the Entourage Effect." *Cannabis Technology News*, 18 June 2020, [www.cannabistech.com/articles/what-is-the-entourage-effect-in-cannabis/](http://www.cannabistech.com/articles/what-is-the-entourage-effect-in-cannabis/).
- <sup>13</sup>Russo, Ethan B. "Taming THC: potential cannabis synergy and phytocannabinoid-terpenoid entourage effects." *British journal of pharmacology* vol. 163,7 (2011): 1344-64. doi:10.1111/j.1476-5381.2011.01238.x
- <sup>14</sup>Arkell, Thomas R. et al. "The Failings of per Se Limits to Detect Cannabis-Induced Driving Impairment: Results from a Simulated Driving Study." *Traffic Injury Prevention*, vol. 22, no. 2, 2021, pp. 102–107., doi:10.1080/15389588.2020.1851685.
- <sup>15</sup>Adams, Dan. "Ediblocked: Some People Can't Get High from Eating Marijuana, and Scientists Aren't Sure Why." *The Boston Globe*, 16 May 2021, [www.bostonglobe.com/2021/05/12/marijuana/ediblocked-some-people-cant-get-high-eating-marijuana-scientists-arent-sure-why/](http://www.bostonglobe.com/2021/05/12/marijuana/ediblocked-some-people-cant-get-high-eating-marijuana-scientists-arent-sure-why/).
- <sup>16</sup>Bidwell LC, Ellingson JM, Karoly HC, et al. Association of Naturalistic Administration of Cannabis Flower and Concentrates With Intoxication and Impairment. *JAMA Psychiatry*. 2020;77(8):787–796. doi:10.1001/jamapsychiatry.2020.0927
- <sup>17</sup>Stith, S.S., Vigil, J.M., Brockelman, F. et al. "The Association between Cannabis Product Characteristics and Symptom Relief." *Scientific Reports* 9, 2712 (2019). <https://doi.org/10.1038/s41598-019-39462-1>
- <sup>18</sup>Noyes R Jr, Brunk SF, Baram DA, Canter A. "Analgesic effect of delta-9-tetrahydrocannabinol." *Journal of Clinical Pharmacology*. 1975 Feb-Mar;15(2-3):139-43. doi: 10.1002/j.1552-4604.1975.tb02348.x.
- <sup>19</sup>Baron EP, Lucas P, Eades J, Hogue O. "Patterns of medicinal cannabis use, strain analysis, and substitution effect among patients with migraine, headache, arthritis, and chronic pain in a medicinal cannabis cohort." *Journal of Headache Pain*. 2018 May 24;19(1):37. doi: 10.1186/s10194-018-0862-2.
- <sup>20</sup>Thompson, Ty. Medical Marijuana Patients Prefer Oklahoma over Arkansas. *Times Record*, 23 Apr. 2020, [www.swtimes.com/news/20200423/medical-marijuana-patients-prefer-oklahoma-over-arkansas](http://www.swtimes.com/news/20200423/medical-marijuana-patients-prefer-oklahoma-over-arkansas).
- <sup>21</sup>Hughes, Zachariah. "THC Levels in Edibles Can Now Double in Alaska. What Does That Mean?" *Anchorage Daily News*, Anchorage Daily News, 10 Aug. 2021, [www.adn.com/alaska-marijuana/2021/08/08/thc-levels-in-edibles-can-now-double-in-alaska-what-does-that-exactly-mean/](http://www.adn.com/alaska-marijuana/2021/08/08/thc-levels-in-edibles-can-now-double-in-alaska-what-does-that-exactly-mean/).
- <sup>22</sup>Leos-Toro, Cesar. "Cannabis Labelling and Consumer Understanding of THC Levels and Serving Sizes." *Drug and Alcohol Dependence*, vol. 208, Mar. 2020, p. 107843., doi:10.1016/j.drugalcdep.2020.107843.
- <sup>23</sup>*Oregon Marijuana Tax: Distribution Information*. Oregon Department of Revenue, 2021, [www.oregon.gov/dor/programs/gov-research/Documents/Financial%20reporting%20distributions%20public.pdf](http://www.oregon.gov/dor/programs/gov-research/Documents/Financial%20reporting%20distributions%20public.pdf).
- <sup>24</sup>Mennis, Jeremy. Trends in Adolescent Treatment Admissions for Marijuana in the United States, 2008–2017. *Centers for Disease Control and Prevention*, 19 Nov. 2020, [www.cdc.gov/pcd/issues/2020/20\\_0156.htm](http://www.cdc.gov/pcd/issues/2020/20_0156.htm).
- <sup>25</sup>Colorado Department of Public Health and Environment, 2018, "Retail Marijuana Education Program: 2017 Annual Report," [www.colorado.gov/pacific/sites/default/files/MJ\\_RMEP\\_FinalMJReport17.pdf](http://www.colorado.gov/pacific/sites/default/files/MJ_RMEP_FinalMJReport17.pdf).