

# State Variation in U.S. Medical Cannabis Limits, Restrictions, and Therapeutic Cannabis Dosing

Shelby R. Steuart<sup>1</sup>

<sup>1</sup>Department of Public Administration & Policy, University of Georgia

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## ABSTRACT

Wide variation exists in the possession limits of cannabis products sold for medical use in the U.S. as well as the tetrahydrocannabinol (THC) content of cannabis products. Prior work has found that legal limits on recreational cannabis sold per transaction may promote moderate use and diversion. This paper finds similar results for monthly medical cannabis limits. In the present analyses, state limits on medical cannabis were aggregated and converted into 30-day limits and 5 milligram (mg) THC doses. Grams of pure THC were calculated using plant weight limits and medical cannabis median THC potency aggregated from Colorado and Washington state medical cannabis retail sales data. Weight in pure THC was then broken down into 5 mg doses. Weight-based possession limits of cannabis for medical use varied widely across states (range: 1.5-762.05 grams pure THC per 30 days), with three states lacking a quantifiable weight limit (in which limits are not by weight but by physician's recommendation). States generally do not impose limits on the potency of cannabis products, therefore small differences in weight limits can result in large differences in the amount of total THC allowed to be sold. Assuming a typical medical dose of 5 mg and the median THC potency of 21%, current laws allow for sales of 300 (Iowa) to 152,410 (Maine) doses per month. Current state statutes and methods of cannabis recommendation allow patients to increase therapeutic THC doses independently, and perhaps unknowingly. High THC content products combined with the higher purchase or possession limits allowed by medical cannabis laws may lead to an increased potential for overconsumption or diversion.

**Key words:** = cannabis; medical cannabis; cannabis policy

There exists vast heterogeneity in state cannabis laws including qualifying medical conditions, approved cannabis products, and the allowance of home cultivation. As of June 3rd, 2022, 38 states and Washington DC have legalized medical cannabis use, with all states except Alabama having some form of medical THC-based treatment currently available (See Supplemental Table 1 for details and citations). Within legalized states, patients purchasing cannabis for medical use must have a physician certify that they have a qualifying condition, pay a fee (which ranges from \$1 to \$300), and possess a license to purchase cannabis. Cannabis purchase amounts are either capped by the state in the form of weight limits or by physicians in the form of "day" limits.<sup>1</sup>

A growing area of concern within medical cannabis policy is identifying dosage information. Because cannabis is labeled as a Schedule I drug at the federal level, physicians and nurse practitioners cannot prescribe medical cannabis and modern clinical studies of cannabis treatment are severely lacking, often leaving patients to determine their own doses (Corroon et al., 2019; Likhitsathian et al., 2021; Morris, 2019; Romero-Sandoval et al., 2018). While purchase caps, in theory, exist to prevent diversion to the illicit market (Hall et al., 2019; Pacula et al., 2021a), the present study sought to determine whether current state-established cannabis limits exceed recommended dosing for medical cannabis consumption.

Corresponding Author: Shelby R. Steuart, Department of Public Administration & Policy, University of Georgia. E-mail: [Shelby.Steuart@uga.edu](mailto:Shelby.Steuart@uga.edu)

<sup>1</sup> For example, a physician may recommend a "30-day limit" of one ounce, but the recommendation will vary by patient.

While numerous other cannabis compounds (such as cannabidiol (CBD) and cannabinal (CBN)) have shown therapeutic value, they are not the focus of this article because they do not possess psychoactive properties and are not scheduled at the federal level (U.S. Department of Justice, 2021).

## METHODS

Data on state medical cannabis limits were gathered from state legal statutes (see Supplemental Table 1). States were coded as currently having an operational medical cannabis program if they have open cannabis dispensaries that allow for the sale of cannabis products above 0.3% THC. State cannabis limits are described in terms of either a possession limit (the amount patients can legally possess on their person or at home), a purchase limit (the amount patients can legally purchase during a fixed period), or no limit. States were coded as having no limit if there is no explicit legal limit in the cited medical cannabis law, for the given consumption category in Supplemental Table 1. Some states address this by allowing physicians to set the limits. States that have both plant weight limits and interdependent purchase limits often require dispensaries to calculate product equivalence so that purchases of all goods do not exceed the plant weight limit. THC product equivalencies are also included in Table 1 and Supplemental Table 1. States where medical cannabis is currently illegal are omitted.

Often states have a whole plant weight limit in the text of their medical cannabis law and later issue subsequent administrative rules establishing THC product equivalency. In order to compare the whole plant limit to the product limit, it was necessary to use the whole plant weight limits to calculate the equivalent number of grams of pure THC. The median percent THC available for medical cannabis patients (21%) was calculated using a list of available strains of medical cannabis in Colorado and Washington state provided by Cash et al (2020)<sup>2</sup> and multiplied the number of grams of whole plant product permitted by the median percent THC to reach the equivalent number of pure THC grams. In the interest of improving the ease of comparison, weight limits were standardized to fit

a 30-day period. This was done by multiplying the weight limit by the number that would make it equivalent to 30 days (for example, 10-day limits were multiplied by 3, 90-day limits were multiplied by 0.33). It is worth noting that the number of grams per ounce varies across states, with some states rounding “28.3495...” up to 28.5 or even 30. In the present analysis, an ounce was considered equivalent to 28.35 grams to be as accurate as possible.

Recent research suggests the standard dose of 5 milligram (mg) THC for researchers studying cannabis (Filbey, 2020a; Freeman & Lorenzetti, 2020; Hammond, 2020; Volkow & Weiss, 2020), regardless of route of administration. While some researchers recommend using 10 mg as the standard recreational dose due to state standards for edible product labeling (Pacula et al., 2021b), numerous studies have shown 5 mg doses are recommended for medical administration, particularly in the treatment of pain where low doses are associated with decreasing perception of pain whereas higher doses are associated with higher perception of pain (Filbey, 2020b; Portenoy et al., 2012; Wilsey et al., 2013). The number of pure THC grams derived from the monthly whole plant limit was multiplied by 1000 to convert to milligrams then divided by the dose in milligrams (Pacula et al., 2021a), to calculate the number of doses in a monthly limit.

Three states - Pennsylvania, New York, and West Virginia - do not currently have weight-based possession or purchase limits because their limits are established for each patient by the recommending physician. These states were omitted from the analyses but their statutes and limitations are included in Supplemental Table 1. The weight limits in all states except Oklahoma and North Dakota are interdependent, meaning the entire purchase may not exceed the equivalence of the whole plant limit. If the state limit is interdependent, the higher of the two calculations (the equivalent grams of pure THC calculated using the flower weight limit or the state pure THC limit) is used. If the state limit is not interdependent, the equivalent grams of pure THC were calculated by adding together the equivalent pure THC grams of all applicable limits.

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<sup>2</sup> Cash et al.'s S1 Data Supporting Information XLSX file contains a dataset of available flower strains for medical cannabis patients in Colorado and Washington state, from dispensaries with established websites. While available strains may vary by state, it is likely many states have similar available strains, but this is included as a limitation.

Table 1. *State Medical Cannabis Limits Expressed in Grams Pure THC, Milligrams Pure THC, and 5 Milligram Doses, Over A 30-Day Period<sup>1</sup>*

State	5 mg Doses	Maximum THC per Month (grams)	Monthly Limit on Whole Plant, Converted to THC (grams)	Monthly Limit on THC in Products (grams)
AL <sup>2</sup>	NA	NA	NA	NA
AK <sup>3</sup>	33,600	168	178.61	168
AZ	6,376	31.88	31.88	10.71
AR	2,976	14.88	14.88	NA
CA	9,526	47.63	47.63	NA
CO	2,380	11.9	11.91	20
CT	4,168	20.84	20.84	1.75
DE	34,020	170.1	35.72	170.1
DC	2,382	11.91	11.91	NA
FL	4,762	23.81	23.81	NA
HI	4,762	23.81	23.81	NA
IA <sup>4</sup>	300	1.5	NA	1.5
IL	6,376	31.88	31.88	2.68
LA	6,376	31.88	31.88	NA
ME	152,410	762.05	762.05	NA
MD	7,200	36	25.18	36
MA	5,954	29.77	29.77	2.5
MI	11,908	59.54	59.54	NA
MN	6,376	31.88	31.88	NA
MS	4,120	20.6	20.60	2.8
MO	6,400	32	23.81	32
MT	5,954	29.77	29.77	4
NV	2,976	14.88	14.88	10
NH	7,144	35.72	35.72	42.6
NJ	3,572	17.86	17.86	NA
NM	5,948	29.74	29.74	28.31
NY <sup>5</sup>	NA	NA	NA	NA
ND <sup>6</sup>	4,372	21.86	17.86	NA
OH	3,568	17.84	17.84	3.30
OK <sup>7</sup>	15,196	75.98	47.63	28.35
OR	28,576	142.88	142.88	5
PA <sup>8</sup>	NA	NA	NA	NA
RI	2,976	14.88	14.88	1.25
SD	3,572	17.86	17.86	2.4
UT	4,738	23.69	23.69	20
VT	2,382	11.91	11.91	NA
VA	4,762	23.81	23.81	NA
WA	4,200	21	17.8605	21
WV <sup>9</sup>	NA	NA	NA	NA

*Note.* Limits expressed in grams have been rounded to two decimal places, and 5 mg doses have been rounded to whole numbers when applicable for brevity.

<sup>1</sup>If the state has both a daily limit and a monthly or possession (at any given time) limit, the monthly/possession limit is reflected in the table.

(Table continues)

<sup>2</sup>Not yet operational, see details in Supplemental Table 1.

<sup>3</sup>Alaskan law stipulates that all flower and cannabis products may not exceed 5600 milligrams, this in effect caps the THC content of flower at 19.75%. This statutory limit is reflected in the calculated limits in this table.

<sup>4</sup>Iowa state cannabis limit is in concentrate, purchase of flower is not allowed at this time.

<sup>5</sup>New York allows the purchase of flower and THC products but there is no statutory limit, limits are set by providers during initial consultation.

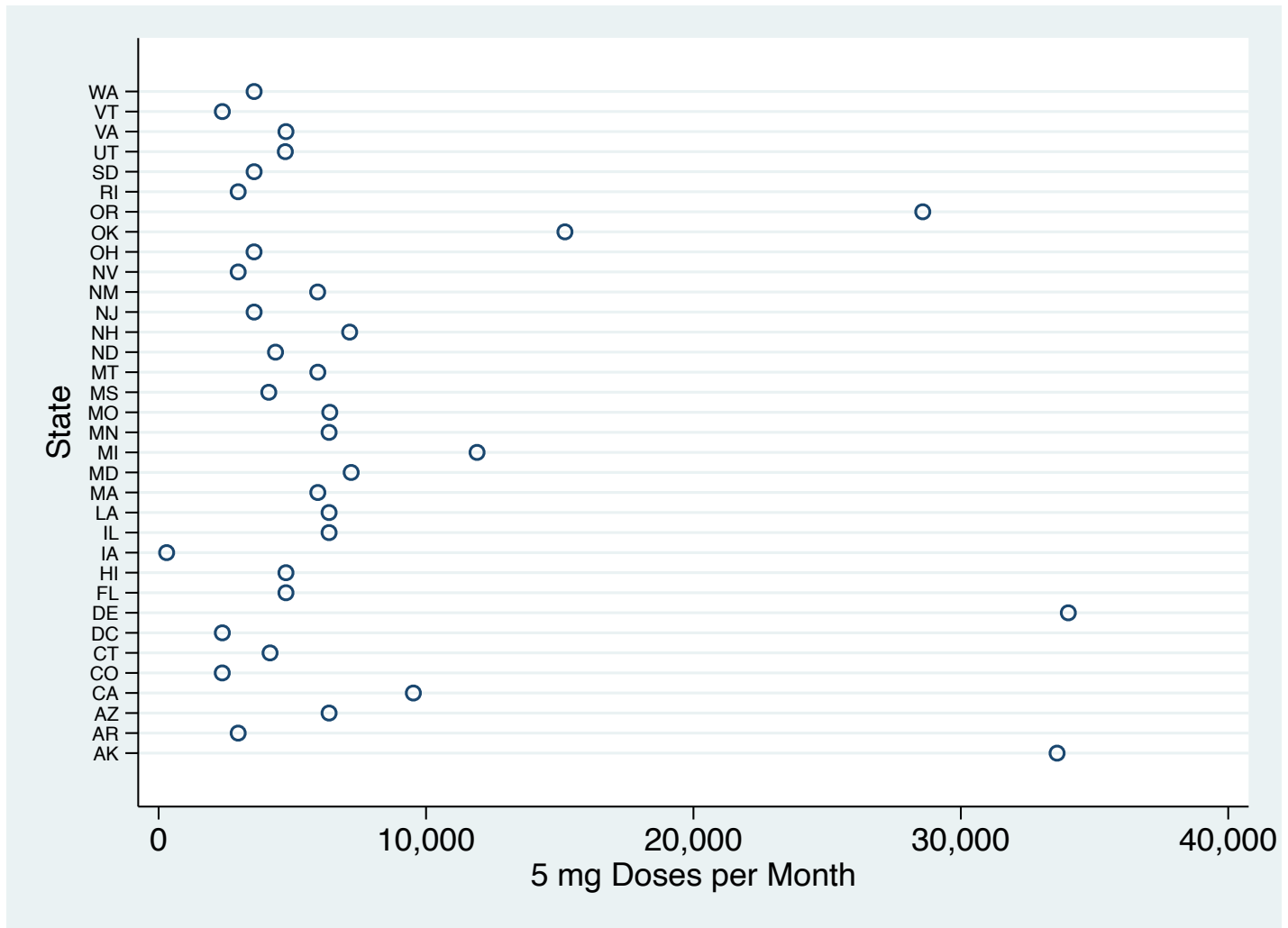
<sup>6</sup>North Dakota's limit is not interdependent; therefore, patients may possess the maximum amount of 100% THC in addition to the maximum amount of flower.

<sup>7</sup>Oklahoma's limit is not interdependent; therefore, patients may possess the maximum amount of 100% THC in addition to the maximum amount of flower.

<sup>8</sup>Pennsylvania allows the purchase of flower and THC products but there is no statutory limit, limits are set by providers during initial consultation.

<sup>9</sup>West Virginia allows the purchase of flower and THC products but there is no statutory limit, limits are set by providers during initial consultation.

Figure 1. *The number of doses of medical cannabis per month allowed by each state's medical cannabis limit.*



*Note.* Limits are calculated using the median THC percentage for the maximum THC allotted (whether flower or cannabis products) and a dose of 5mgs. Maine has been excluded due to illegibility caused by the extremely high limit (equivalent to over 150,000 doses per month). States that have a physician-set limit are omitted from the figure since they do not have a statutory dose limit.

## RESULTS

The median number of grams of THC per 30-day period is 23.8 grams from whole plant cannabis and 10.4 from THC products. Because of the influence of Maine, which with a medical cannabis possession limit of 8 pounds (3628.8 grams) of plant material at any given time was a significant outlier (see Table 1), the mean number of THC grams was 55.3 from whole plant cannabis and 27.9 from THC products. The number of 5 mg THC doses ranged from 300 in Iowa to 152,410 in Maine. The median number of 5 mg THC doses permitted per 30-day period was 4,763 doses and the mean number was 11,762 doses. Over 75% of states currently permit fewer than 10,000 doses per 30-day period (see Table 1 and Figure 1).

Most state medical cannabis limits represent a combination of whole plant, THC products, and home cultivation. For several reasons, including the wide variation in the amount of cannabis that can be grown by home cultivators, this paper focused on purchasable cannabis only; home cultivation limits were not included in limit calculations. All states that currently have an operational medical cannabis program allow for some form of THC products and, except for Iowa, allow patients to have access to whole plant cannabis.

## DISCUSSION

Our results present quantities of doses an order of magnitude greater than Pacula et al (2021), who calculated the transaction limits of recreational cannabis. This is at least in part because recommended medical cannabis doses are lower than average recreational doses (5 mg as opposed to 10 mg) and limits are standardized to 30-day periods (not transactions). However, medical cannabis limits are higher than recreational cannabis limits for all states that have both medical and recreational cannabis access, except for Michigan.<sup>3</sup> This could be because the medical cannabis laws were written with the most severe patients in mind, because fewer people use medical cannabis than recreational, or potentially because medical users' conditions require large amounts of cannabis to treat. Additionally, while medical users have a

lower recommended dose, they report using more cannabis and spending more money on cannabis than recreational users (Pacula et al., 2016), perhaps because they consume more frequently and more regularly, and build up tolerance quicker than recreational users (Haug et al., 2017; Kim et al., 2019; Salazar et al., 2019).

Regardless, the possession and purchase limits appear to be well above usage behavior in most states (Grella et al., 2014; Kepple & Freisthler, 2018; Kim et al., 2019). This begs the question, if registered medical cannabis users can purchase so much more than they require medically, could the limits be exploited to divert cannabis to the illicit market? Or conversely, could such high limits encourage problematic overuse of cannabis?

It is also worth noting the number of doses a patient can purchase varies based on the percent THC and the products they choose to purchase. While for most states purchasing cannabis flower at the median THC potency provides the patient with more total grams of THC than if the patient were to purchase other products, a few states either have product limits that provide the user with more THC than their flower limits using the median THC potency or have non-interdependent limits. This means the patient can purchase both the maximum amount of flower and the maximum amount of THC products per month. In the case, in our analyses, where state statutes or regulations included a pure THC limit, whichever product provided the highest number of doses of THC per month was used.

## LIMITATIONS

Medical cannabis research is a field that is evolving rapidly but still has many gaps. While this paper attempts to fill some of those gaps, a few limitations must also be acknowledged. First, calculations on the median THC potency for flower products were determined from a database of available cannabis strains at dispensaries with established websites in Colorado and Washington state (Cash et al., 2020) without knowledge of which strains are the most popular or how the potency varies across all medical cannabis states, over time.

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<sup>3</sup>From a comparison between Pacula et al.'s recreational cannabis limits and Supplemental Table 1.

Pacula et al. (2021) calculated the number of pure THC doses recreational users can purchase per transaction, but this study focuses on the number of pure THC doses medical cannabis users can purchase per 30-day period. The reasons for this are twofold: first, medical cannabis is recommended for long-term, chronic illnesses or symptoms (Boehnke et al., 2019) and thus medical cannabis is used regularly (not “as needed”) and in consistent amounts (Bonn-Miller et al., 2014). Therefore, it is reasonable to consider the amount these patients are able to access over a period of time rather than at a point of sale. Second, because of their consistent use of cannabis, medical cannabis users can be assumed to have a regular purchasing pattern, the same way patients regularly pick up prescriptions. Therefore, it makes more sense to think of a scenario where patients purchase the maximum amount of cannabis each time they visit a dispensary to evaluate how much unused cannabis could potentially be in their possession. This paper argues that high limits in medical cannabis states, especially where recreational cannabis is still illegal, could potentially lead to higher accidental diversion because high limits, regular purchase patterns, and regular cannabis use make it challenging for users to track the exact amount in their possession at a given time. However, the limitation in this approach is that information on how much medical cannabis users are using in each month is not available, therefore calculating an excess amount is not feasible. Another limit in this approach is in the case of Alaska, medical cannabis patients can purchase an ounce per day, but can only ever have an ounce in their possession. Alaska is coded as a maximum of 30 ounces per month. While Alaska’s code makes it consistent with the other states in the sample, it is very unlikely that patients are doing that in Alaska.

## CONCLUSIONS

Clinical research on appropriate medical cannabis dosing by condition is still developing; however, it is clear the current medical cannabis limits allow for very large cannabis purchases. Since most states do not have THC potency limits or weight limits that take the THC potency into account, patients could increase the total number of doses they purchase by purchasing cannabis

with very high potency. Some states also allow for limits to be increased or waived based on patient cannabis need. In addition to providing the potential for overconsumption, high limits provide an opportunity for diversion to the illicit market. As research develops and physicians become more knowledgeable about cannabis, they could fill a role in helping patients determine ideal doses and THC potency for specific indications. This could also open the door to policymakers establishing weight limits that would be more aligned to the goal of providing relief to patients without the potential for overconsumption and diversion.

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