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Dosing Medical Marijuana: Rational Guidelines on Trial in Washington State

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The medicinal value of cannabis is well documented in the medical literature.[1,2] Cannabinoids, the active ingredients, are found in the resin-producing pistillate inflorescences of the *Cannabis sativa* plant.[3] Since the early 1900s, cannabis has been referred to as mari(hj)uana, a pejorative term derived from Mexican Spanish-Portuguese colloquial slang. Cannabinoids have many distinct pharmacologic properties. These include analgesic, antiemetic, antioxidative, neuroprotective, and anti-inflammatory activity, as well as modulation of glial cells and tumor growth regulation.[1] We now know that there is an endogenous molecular signaling system in our bodies that is run by cannabinoids. The discovery of this endogenous cannabinoid system with specific receptors and ligands has led to the progression of our understanding of the therapeutic actions of cannabis from folklore to valid science.[4] It now appears that the cannabinoid system evolved with our species and is intricately involved in normal human physiology, specifically in the control of movement, pain, appetite, memory, immunity, and inflammation, among others. The detection of widespread cannabinoid receptors in the brain and peripheral tissues suggests that the cannabinoid system represents a previously unrecognized, ubiquitous network in the nervous system. On that basis, exogenous cannabinoids appear to have tremendous potential in treating neurodegenerative disorders.[5,6] For example, in amyotrophic lateral sclerosis (ALS), there is animal model evidence that exogenous cannabinoids have disease-modifying potential.[7-12] Further, in a large survey, ALS patients reported that marijuana relieved the major symptoms of the disease better than prescription medications.[13] The most common reason cited by ALS patients for not considering using cannabis to treat their symptoms was lack of access.[13]

Dense cannabinoid receptor concentrations have been found in the cerebellum, basal ganglia, and hippocampus, accounting for the effects of cannabis on motor tone, coordination, and mood state.[4] Low concentrations are found in the brainstem, accounting for the remarkably low toxicity of cannabis. Of note, lethal doses for cannabis in humans have not been described. So far, we know of at least 2 molecular receptor proteins (CB1 and CB2) and 2 endogenously produced lipid

cannabinoids (anandamide and 2-acylglycerol) found in numerous tissues throughout the body, including neural and immune tissues, which comprise the endogenous cannabinoid system.[1,3,4] The cannabinoid system helps regulate the function of other systems in the body, making it an integral part of the central homeostatic modulatory system – the check-and-balance molecular signaling network in our bodies that keeps us at a healthy “98.6.” Despite all of the advances in understanding the physiology and pharmacology of cannabis and cannabinoids, there remains a strong need for developing rational guidelines for dosing cannabis. We (Gregory T. Carter [GTC] and Muraco Kyashna-Tocha [MKT]) have previously attempted to address this issue, deriving a dosing scheme with the available known chemistry and pharmacology of cannabis.[14] However, it would appear that there is still considerable controversy over this issue.

Legal Ease: What the Law Really Says (and Why You Should Know)

Fourteen states and the District of Columbia have passed medical marijuana legislation attempting to provide protection for medical marijuana patients. Our own state law dates back to November 3, 1998, when voters in Washington passed I-692, also known as the medical marijuana initiative, by a 59% margin (RCW 69.51A). The law states that “Qualifying patients...shall not be found guilty of a crime under state law for their possession and limited use of marijuana.” One might ask, “Why do I need to know this much about the law?” For starters, the law does not protect patients (or their caregivers) from arrest or prosecution.[15,16] It only allows them to present a medical marijuana defense in court. One of us (GTC) has had several patients who were following the law perfectly well, only to be arrested for either possession or cultivation. Moreover, he (GTC) has had to go to court to testify on their behalf and have had several occasions in which a judge or prosecuting attorney will directly question my medical judgment. This occurs despite the fact that this is an area in which my peers in medicine generally consider me an expert – granted that the charges are usually dropped but not without the expense and time taken going to court. Patients have had their growing equipment confiscated, only to be returned later in damaged condition.

Patients should always be advised that any state medical marijuana law, such as our I-692, does not offer any protection from federal law. Federal law still makes marijuana possession, distribution, or manufacture illegal for any purpose. Furthermore, the US Supreme Court has also ruled that the federal government can arrest state-recognized medical cannabis patients.[17,18] These are the legal absurdities and risks under which state-permitted medical marijuana patients exist.

Popular press and patient networks have estimated that there are approximately 20,000 qualifying medical marijuana patients in Washington state. If the physician-authorizing rate in Washington state resembles Oregon, which has a similarly aged program, we can estimate that roughly 1000–2000 licensed physicians have authorized the use of medical marijuana for their patients in Washington state. Given the sheer number of patients and physicians involved, one would think that there would be rather defined recommendations with regard to dosing. Indeed, the law as it has existed states only that an individual may “possess, in combination with and as an agent for the qualifying patient, no more marijuana than is necessary for the patient's personal, medical use, not exceeding the amount necessary for a sixty-day supply.” Adding to the confusion, recently passed legislation amending the existing state law has given the Washington State Department of Health (WA DOH) the rulemaking authority to “define the quantity of marijuana that could reasonably be presumed to be a sixty-day supply for qualifying patients.”

Given the controversy that this has generated, not only here but also in virtually all states dealing with medical marijuana, we would like to further derive a scientifically grounded, logic-based framework to help states with a medical marijuana policy address the issue of dosing. Specifically for Washington state, we will also address the question of what “could reasonably be presumed to

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be a sixty-day supply for qualifying patients?" It should be obvious that defining a 60-day supply is equivalent to defining a 1-day supply and multiplying that figure by 60. It is also roughly equivalent to defining a 1-week supply and multiplying that figure by 8 or dividing an annual supply by 6.

Deriving Dosing Guidelines for Medical Marijuana: Clearing the Smoke

Let us begin with some basic definitions. According to state law, "*Medical use of 'marijuana'* means the production, possession, or *administration of marijuana*, as defined in RCW 69.50.101(q), for the exclusive benefit of a qualifying patient in the treatment of his or her terminal or debilitating illness" (RCW 69.51A.010, Section 1, emphasis added). In this definition, the concept that is most relevant to the question at hand is the administration of marijuana. This is a technical concept defined in law. The relevant statute cited is RCW 69.50.101(q). The definition there for our purposes is as follows: "Administer" means to apply a controlled substance, whether by injection, inhalation, ingestion, or any other means, directly to the body of a patient...by...(2) the patient." Thus, the "medical use of marijuana" means the administration of a supply of marijuana directly to the body of a qualifying patient by the patient. Route of administration is an important determinant of the pharmacokinetics of the various cannabinoids in cannabis, particularly absorption and metabolism. Typically, cannabis is smoked, which has the advantage of rapid onset of effect and easy dose titration.[19-21] Due to their volatility, cannabinoids will vaporize at a much lower temperature than combustion, allowing them to be inhaled as a warm air mist.[22] This is a much healthier option than smoking.[22] However, there may be differing vaporization points for the individual cannabinoids. Thus, vaporized cannabis may have differing concentrations and ratios of cannabinoids compared with smoked cannabis.[22,23] Cannabinoids in the form of an aerosol in inhaled smoke or vapors are absorbed and delivered to the brain and circulation rapidly, as expected of a highly lipid-soluble drug.[24,25] With smoking, up to 40% of the available cannabinoids may be completely combusted or lost in sidestream smoke and thus be biologically unavailable.[21]

Cannabis may also be ingested orally, but this delivery route has markedly different pharmacokinetics compared with inhalation. The onset of action is delayed and titration of dosing is more difficult.[14,23] Maximum cannabinoid blood levels are only reached up to 6 hours post ingestion, with a much longer half-life, as long as 20-30 hours.[23] This would apply to dronabinol (*Marinol*), the pharmacokinetics of which were used as the foundation of our original dosing guidelines.[14] With respect to dronabinol, which is 100% pure, synthetic delta-9 tetrahydrocannabinol (THC), this is converted in the liver to 11-hydroxy-THC, a potent psychoactive agent. This metabolite accounts for the considerable sedation that patients often experience with dronabinol. Despite the persistent warnings from the Drug Enforcement Agency (DEA) that "today's marijuana is stronger," both the US Food and Drug Administration (FDA) and the DEA agreed to reclassify the scheduling status of dronabinol from a Schedule II (CII) to a Schedule III (CIII) controlled substance, due to its remarkable safety profile (which is inherent to all cannabinoids). The cannabinoids may also be made in to a liniment and absorbed through the skin. This was a common treatment for arthritis around the turn of 20th century. However, this is the least efficient mode of delivery.

The WA DOH must be aware of these common modes of administration and establish a 60-day supply that presumes that any and all of these common methods of administration of medical marijuana are being employed by qualifying patients. Given the inherent variations in strain and phenotype of cannabis, the various routes of administration employed, and the multitude of debilitating or terminal conditions being treated in patients using medicinal cannabis, standards must be set that maximize the potential for symptomatic relief. To do anything less would be unethical.[26] Minimally, this implies setting standards with respect to the use of the least potent strains of marijuana and the most amount-intensive routes of administration.

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The logical place to begin with regard to addressing the question of what constitutes a medically reasonable supply range is to investigate current dosing/supply precedents in American cannabinoid medicine. First and foremost, the WA DOH should draw from the experience of the longest running medical marijuana supply program in the United States, this being the ongoing, now 3-decades-old, Compassionate Single Investigational New Drug Program. The National Institute on Drug Abuse (NIDA) and the FDA jointly administer this. This program has supplied enrolled patients with nearly half a ton of marijuana throughout its cumulative history! The cannabis plants are grown at a federally funded farm in Oxford, Mississippi. After curing (air-drying), the cannabis is rolled into cigarettes at the Research Triangle Institute outside of Durham, North Carolina. Grey metal tins are used to package the cannabis cigarettes, which are then shipped monthly to 5 secured pharmacies in the United States for delivery and consumption by the 5 individuals whose healthcare providers long ago attested in writing to the vital health and medical benefits that consumption of cannabis affords them. The director of the Mississippi farm has stated on the public record that they have been able to produce, stock, and supply medicinal cannabis with strengths as high as 14% THC.[27] The marijuana is produced and supplied for consumption with the full financial backing and imprimatur of the US federal government, the NIDA, and the FDA, as part of a program that was reluctantly started 3 decades ago on the order of a federal judge who ruled that "medical necessity" to use marijuana was an unalienable right possessed by one man whose vision was deteriorating from glaucoma, and which the US government is legally obligated to respect, protect, and fulfill.

One of us (Sunil K. Aggarwal [SKA]) can attest to personally meeting with the horticulturalist who has been growing medical marijuana for the federal government's marijuana supply program for nearly 3 decades, Dr. Mahmood El Sohly. In addition, he (SKA) has met with 3 of the qualifying patients in the program who have chosen to go public: George McMahan, who suffers from nail-patella syndrome; Irv Rosenfeld, who suffers from multiple congenital cartilaginous exostoses; and Elvy Musikka, who suffers from congenital cataracts and glaucoma. Russo and colleagues[28] summarized the supply that 4 of the 5 remaining patients in the program are receiving. On the basis of those reported figures, Conrad[29] summarized the average supply for each patient in the federal program, assuming roughly equal strain strength. According to Conrad, the annual dose is between 5.6 and 7.23 lb of cannabis bud mixed with leaf. Thus, the documented federal single-patient dosage averages 8.24 g/day, or about one fourth ounce per day, which amounts to 6.63 lb smoked per year.

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Thus, following the federal guidelines, an average of 6.63 lb of smoked medical marijuana, per patient per year, translates to a 60-day supply of 1.105 lb (assuming six 60-day periods per year) per patient. We emphasize here that this calculation is for administration of herbal cannabis through combustion-driven lung absorption only because this is the sole method of administration considered in the federal program, as the marijuana is delivered prerolled into cigarettes for smoking. In order to administer an equivalent amount of marijuana through gut absorption, an estimated 3–5 times greater quantity of marijuana is required, assuming equal efficiency and loss in both processes. Validation of this conversion factor comes from dose considerations elucidated by Dr. Reese Jones, MD, a professor of psychiatry at the University of California, San Francisco, School of Medicine. In a published federal document, submitted on record, to Congress, Dr. Jones opined: "THC has been estimated to be 3 to 5 times more potent when inhaled than when ingested.[30]" He then gave a concrete example: "A marijuana cigarette containing 2 percent THC would deliver slightly less than 10 milligrams of THC to the lungs where must [sic] is probably absorbed. But to reach an equivalent state of intoxication when taken orally, from 30 to 50 milligrams of THC would have to be consumed.[30]" We can use this same conversion factor, even though we are interested in medically desired endpoints. Applying an average multiplication factor of 4 (which is between 3 and 5) would mean that if the federal medical marijuana patients received a supply of marijuana intended for gut absorption in order to achieve pharmacologically equivalent

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blood levels as achieved through combustion and inhalation, an annual supply of $6.63 \text{ lb} \times 4 = 26.52 \text{ lb}$ per patient would be required. Dividing by 6, this translates to a 60-day supply of $(26.52 \text{ lb}/6 =) 4.42 \text{ lb}$ or 70.72 oz per patient.

In our previous study, we (GTC and MKT) used a different method to estimate a 60-day supply. In that study, we based our supply recommendations on the dosing regimen of dronabinol, a soft gelatin-encapsulated, synthetic THC isomer dissolved in sesame seed oil. This has been sold since 1985, with FDA approval, under the trade name *Marinol*. We took the very conservative dronabinol dosing model and applied it to standard combustion-and-inhalation pharmacokinetics for cannabis. Applying this to the least potent strains, we derived a 60-day cannabis supply of 15.7 oz, which is essentially 1 lb. This is strikingly similar to the 1.105 lb of smoked marijuana as calculated above. Applying our gut delivery 4-fold conversion factor, this translates to a 60-day supply of 62.8 oz or 3.925 lb.

Admittedly, there are limitations with this approach, given the fact that much higher doses of THC are tolerated when delivered as part of the full cannabis chemical cocktail vs when taken in pure form, but its logical results do seem concordant with what patients who are delivering combusted cannabis via the lungs have reported. However, in our prior dosing article, we stressed 3 very important points that should not be overlooked: First, long-term cannabis users can, and probably will, develop some degree of tolerance. Thus, it is conceivable that a long-term cannabis user may require significantly larger amounts of cannabis to achieve a therapeutic effect. Given that there is no known LD50 for cannabis, this should not be a major concern. Second, patients who choose to ingest cannabis will likely require significantly higher amounts. Third, until more refined and purified cannabinoid preparations are available, it will simply not be possible to derive a more specific or exact dosing schedule. Frankly, it was never our intent to advance an *exact* dosing schedule, but rather to provide some guidelines for the dosing of medicinal cannabis that were based on science and reason, not propaganda or agenda.

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We end by concluding that any government agency, including the WA DOH, should adopt presumptive dosing and supply limits that are based on an understanding of the best scientific evidence that is currently available in the field of cannabinoid medicine. Any other presumption would go against the prevailing tide of evidence-based guidelines in medicine and public health. To do otherwise would also be contrary to the mission of our WA DOH – or any state agency in any state in our country, for that matter.

As for the question of how many cannabis plants should a patient or caregiver be allowed to have (which would theoretically provide the aforementioned amounts of medical marijuana), this is not necessarily germane to the question of dosing. Rather, this is an issue that is best addressed by authorities in the sciences of cannabis botany and horticulture. Anything short of that would be a validation of the excessive politicization of cannabis germplasm maturation, which continues to be a federal felony. Thus, if the Department of Health feels compelled to establish a plant limit, then they should choose an upper bound that respects the excesses of federal law. The figure of 99 plants is most appealing because at 100 plants the federal mandatory minimum 5-year incarceration penalty applies. It is time to value the promotion of health and quality of life over such legal absurdities.

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Footnotes

Reader Comments on: Dosing Medical Marijuana: Rational Guidelines on Trial in Washington State See reader comments on this article and provide your own.

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References

1. Carter, GT; Weydt, P. Cannabis: old medicine with new promise for neurological disorders. *Curr Opin Investig Drugs*. 2002;3:437-440.
2. Russo, EB. History of cannabis and its preparations in saga, science, and sobriquet. *Chem Biodivers*. 2007;4:1614-1648. [[PubMed](#)]
3. Sirikantaramas, S; Taura, F; Morimoto, S; Shoyama, Y. Recent advances in Cannabis sativa research: biosynthetic studies and its potential in biotechnology. *Curr Pharm Biotechnol*. 2007;8:237-243. [[PubMed](#)]
4. Pacher, P; Batkai, S; Kunos, G. The endocannabinoid system as an emerging target of pharmacotherapy. *Pharmacol Rev*. 2006;58:389-462. [[PubMed](#)]
5. Carter, GT; Rosen, BS. Marijuana in the management of amyotrophic lateral sclerosis. *Am J Hosp Palliat Care*. 2001;18:264-270. [[PubMed](#)]
6. Carter, GT; Ugalde, VO. Medical marijuana: emerging applications for the management of neurological disorders. *Phys Med Rehabil Clin N Am*. 2004;15:943-954. [[PubMed](#)]
7. Raman, C; McAllister, SD; Rizvi, G; Patel, SG; Moore, DH; Abood, ME. Amyotrophic lateral sclerosis: delayed disease progression in mice by treatment with a cannabinoid. *Amyotroph Lateral Scler Other Motor Neuron Disord*. 2004;5:33-39. [[PubMed](#)]
8. Witting, A; Weydt, P; Hong, S; Kliot, M; Moller, T; Stella, N. Endocannabinoids accumulate in spinal cord of SOD1 transgenic mice. *J Neurochem*. 2004;89:1555-1557. [[PubMed](#)]
9. Kim, K; Moore, DH; Makriyannis, A; Abood, ME. AM1241, a cannabinoid CB2 receptor selective compound, delays disease progression in a mouse model of amyotrophic lateral sclerosis. *Eur J Pharmacol*. 2006;542:100-105. [[PubMed](#)]
10. Shoemaker, JL; Seely, KA; Reed, RL; Crow, JP; Prather, PL. The CB2 cannabinoid agonist AM-1241 prolongs survival in a transgenic mouse model of amyotrophic lateral sclerosis when initiated at symptom onset. *J Neurochem*. 2007;101:87-98. [[PubMed](#)]
11. Weydt, P; Hong, S; Witting, A; Moller, T; Stella, N; Kliot, M. Cannabinol delays symptom onset in SOD1 (G93A) transgenic mice without affecting survival. *Amyotroph Lateral Scler Other Motor Neuron Disord*. 2005;6:182-184.

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[PubMed]

12. Carter, GT; Krivckas, LS; Weydt, P; Weiss, MD; Miller, RG. Drug therapy for amyotrophic lateral sclerosis: where are we now? *IDrugs*. 2003;6:147-153. [PubMed]
13. Amtmann, D; Weydt, P; Johnson, KL; Jensen, MP; Carter, GT. Survey of cannabis use in patients with amyotrophic lateral sclerosis. *Am J Hosp Palliat Care*. 2004;21:95-104. [PubMed]
14. Carter, GT; Weydt, P; Kyashna-Tocha, M; Abrams, DI. Medical marijuana: rational guidelines for dosing. *IDrugs*. 2004;7:464-470. [PubMed]
15. Seamon, MJ. The legal status of medical marijuana. *Ann Pharmacother*. 2006;40:2211-2215. [PubMed]
16. Aggarwal, S; Carter, GT; Steinborn, J. Clearing the air: what the latest Supreme Court decision regarding medical marijuana really means. *Am J Hosp Palliat Med*. 2005;22:327-329.
17. Steinborn, J; Chinn, AK; Carter, GT. The latest buzz on medicinal marijuana: a legal and medical perspective. *Am J Hosp Palliat Med*. 2001;18:295-296.
18. Carter, GT; Mirken, B. Medical marijuana: politics trumps science at the FDA. *MedGenMed*. 2006;8:46. [PubMed]
19. Barnett, G; Licko, V; Thompson, T. Behavioral pharmacokinetics of marijuana. *Psychopharmacology*. 1985;85:51-56. [PubMed]
20. Huestis, MA; Henningfield, JE; Cone, EJ. Blood cannabinoids. 1. Absorption of THC and formation of 11-OH-THC and THC COOH during and after smoking marijuana. *J Anal Toxicol*. 1992;16:276-282. [PubMed]
21. Huestis, MA; Sampson, AH; Holicky, BJ; Henningfield, JE. Characterization of the absorption phase of marijuana smoking. *Clin Pharmacol Ther*. 1992;52:31-41. [PubMed]
22. Hazekamp, A; Ruhaak, R; Zuurman, L; van Gerven, J; Verpoorte, R. Evaluation of a vaporizing device (Volcano) for the pulmonary administration of tetrahydrocannabinol. *J Pharm Sci*. 2006;95:1308-1317. [PubMed]
23. Matthias, P; Tashkin, DP; Marques-Magallanes, JA; Wilkins, JN; Simmons, MS. Effects of varying marijuana potency on deposition of tar and delta9-THC in the lung during smoking. *Pharmacol Biochem Behav*. 1997;58:1145-1150. [PubMed]
24. Agurell, S; Halldin, M; Lindgren, JE, et al. Pharmacokinetics and metabolism of delta 1-tetrahydrocannabinol and other cannabinoids with emphasis on man. *Pharmacol Rev*. 1986;38:21-43. [PubMed]
25. Heishman, SJ; Stitzer, ML; Yingling, JE. Effects of tetrahydrocannabinol content on marijuana smoking behavior, subjective reports, and performance. *Pharmacol Biochem Behav*. 1989;34:173-179. [PubMed]
26. Barnes, RE. Reefer madness: legal & moral issues surrounding the medical prescription of marijuana. *Bioethics*. 2000;14:16-41. [PubMed]
27. US Department of Justice Drug Enforcement Administration: In the matter of Lyle E. Craker, PhD. Arlington, Va. Docket No. 05-16: 1167. 2005.
28. Russo, E; Mathre, M; Byrne, A, et al. Chronic cannabis use in the compassionate investigational new drug program: an examination of benefits and adverse effects of legal clinical cannabis. *J Cannabis Ther*. 2002;2:3-57.
29. Conrad, C. Medical Marijuana Garden Guidelines. El Cerrito, Calif: Creative Xpressions; 2004. Cannabis yields and dosage: the science and reason behind the safe access now. Available at: <http://www.safeaccessnow.net/pdf/cannabisyieldsdosage-rgb.pdf> Accessed September 5, 2007.
30. Jones, R. Human effects: an overview. In: Peterson RC, editor. *Marijuana Research Findings: 1980*. Washington, DC: US Government Printing Office; 1980. pp. 54-80. NIDA Research Monograph 31, June 1980.

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