

## More Reasons States Should Not Legalize Marijuana



# Medical and Recreational Marijuana: Commentary and Review of the Literature

by Samuel T. Wilkinson, MD

*Marijuana should undergo the same rigorous approval process as other medications prescribed by physicians, including randomized, placebo- and active-controlled trials to evaluate safety and efficacy, not by popular vote or state legislature.*

### Abstract

Recent years have seen substantial shifts in cultural attitudes towards marijuana for medical and recreational use. Potential problems with the approval, production, dispensation, route of administration, and negative health effects of medical and recreational marijuana are reviewed. Medical marijuana should be subject to the same rigorous approval process as other medications prescribed by physicians. Legalizing recreational marijuana may have negative public health effects.

### Introduction

Recent years have seen a cultural shift in attitudes towards marijuana. At the time of this writing, medical marijuana is legal in 20 states and the District of Columbia; recreational marijuana is now legal in Washington and Colorado. A substantial and growing literature documents legalized marijuana may have adverse effects on individual and public health.

### Medical Use of Marijuana

The term 'medical marijuana' implies that marijuana is like any other medication prescribed by a physician. Yet the ways in which medical marijuana has been approved, prescribed, and made available to the public are very different from other commercially available prescription drugs. These differences



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pose problems unrecognized by the public and by many physicians.

### Lack of Evidence for Therapeutic Benefit

In the United States, commercially available drugs are subject to rigorous clinical trials to evaluate safety and efficacy. Data appraising the effectiveness of marijuana in conditions such as HIV/AIDS, epilepsy, and chemotherapy-associated vomiting is limited and often only anecdotal.<sup>1,2</sup> To date, there has been only one randomized, double-blind, placebo- and active-controlled trial evaluating the efficacy of smoked marijuana for any of its potential indications, which showed that marijuana was superior to placebo but inferior to Ondansetron in treating nausea.<sup>3</sup> Recent reviews by the Cochrane Collaboration find insufficient evidence to support the use of smoked marijuana for a number of potential indications, including pain related to rheumatoid arthritis,<sup>4</sup> dementia,<sup>5</sup> ataxia or tremor in multiple sclerosis,<sup>6</sup> and cachexia and other symptoms in HIV/AIDS.<sup>2</sup> This does not mean, of course, that components of marijuana do not have potential therapeutic effects to alleviate onerous symptoms of these diseases; but, given the unfavorable side effect profile of marijuana, the evidence to justify use in these conditions is still lacking.

### Contamination, Concentration & Route of Administration

Unlike any other prescription drug used for medical purposes, marijuana is not subject to central regulatory oversight. It is grown in dispensaries, which, depending on the state, have regulatory standards ranging from strict to almost non-existent. The crude marijuana plant and its products may be contaminated with fungus or mold.<sup>7</sup> This is especially problematic for immunocompromised patients,<sup>8</sup> including those with HIV/AIDS or cancer.<sup>9</sup> Furthermore, crude marijuana contains over 60 active cannabinoids,<sup>10</sup> few of which are well studied. Marijuana growers often breed their plants to alter the concentrations of different chemical compounds. For instance, the concentration of tetrahydrocannabinol (THC), the principal psychoactive ingredient, is more than 20-fold more than in marijuana products used several decades ago. Without rigorous clinical trials, we have no way of knowing which combinations of cannabinoids may be therapeutic and which may be deleterious. As marijuana dispensaries experiment by breeding out different cannabinoids in order to increase the potency of THC, there may be unanticipated negative and lasting effects for individuals who smoke these strains.

Marijuana is the only ‘medication’ that is smoked, and, while still incompletely understood, there are legitimate concerns about long-term effects of marijuana smoke on the lungs.<sup>11,12</sup> Compared with cigarette smoke, marijuana smoke can result in three times the amount of inhaled tar and four times the amount of inhaled carbon-monoxide.<sup>13</sup> Further, smoking marijuana has been shown to be a risk factor for lung cancer in many<sup>14,15</sup> but not all<sup>16</sup> studies.

### High Potential for Diversion

In some states, patients are permitted to grow their own marijuana. In addition to contributing to problems such as contamination and concentration as discussed above, this practice also invites drug diversion. Patients seeking to benefit financially may bypass local regulations of production and sell home-grown marijuana at prices lower than dispensaries. We do not allow patient to grow their own opium for treatment of chronic pain; the derivatives of opium, like marijuana, are highly addictive and thus stringently regulated.

### Widespread “Off-label” Use

FDA-approved forms of THC (Dronabinol) and a THC-analog (Nabilone), both available orally, already exist. Indications for these drugs are HIV/AIDS cachexia and chemotherapy-associated nausea and vomiting. Unlike smoked, crude marijuana, these medications have been subject to randomized, placebo-controlled, clinical trials. Yet despite these limited indications where marijuana compounds have a proven but modest effect in high-quality clinical trials, medical marijuana is used overwhelmingly for non-specific pain or muscle spasms. Recent data from Colorado show that 94% of patients with medical marijuana cards received them for treatment of “severe pain.”<sup>17</sup> Similar trends are evident in California.<sup>18</sup> Evidence for the benefit of marijuana in neuropathic pain is seen in many<sup>19-21</sup> but not all<sup>22</sup> clinical trials. There is no high-quality evidence, however, that the drug reduces non-neuropathic pain; this remains an indication for which data sufficient to justify the risks of medical marijuana is lacking.<sup>4, 23-25</sup>

If marijuana is to be ‘prescribed’ by physicians and used as a medication, it should be subject to the same rigorous approval process that other commercially available drugs undergo. Potentially therapeutic components of marijuana should be investigated, but they should only be made available to the public after adequately powered, double-blind, placebo-controlled trials have demonstrated efficacy and acceptable safety profiles. Furthermore, these compounds should be administered in a way that poses

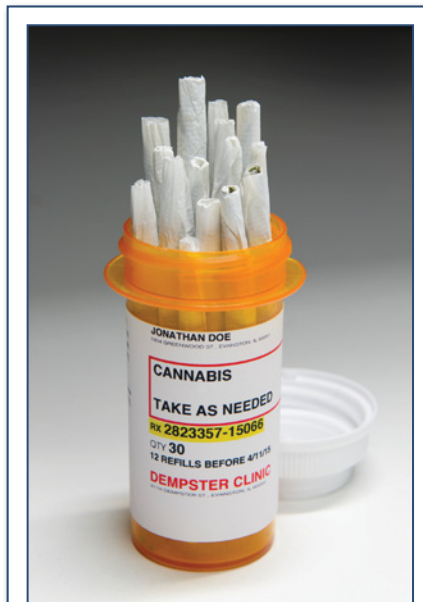
less risk than smoking and dispensed via standardized and FDA-regulated pharmacies to ensure purity and concentration. Bypassing the FDA and approving ‘medicine’ at the ballot box sets a dangerous precedent. Physicians should be discouraged from recommending medical marijuana. Alternatively, consideration can be given to prescribing FDA-approved medicines (Dronabinol or Cesamet) as the purity and concentration of these drugs are assured and their efficacy and side effect profiles have been well documented in rigorous clinical trials.

### Recreational Marijuana

The question of recreational marijuana is a broader social policy consideration involving implications of the effects of legalization on international drug cartels, domestic criminal justice policy, and federal and state tax revenue in addition to public health. Yet physicians, with a responsibility for public health, are experts with a vested interest in this issue. Recent legislation, reflecting changes in the public’s attitudes towards marijuana, has permitted the recreational use of marijuana in Colorado and Washington. Unfortunately, the negative health consequences of the drug are not prominent in the debate over legalizing marijuana for recreational use. In many cases, these negative effects are more pronounced in adolescents. A compelling argument, based on these negative health effects in both adolescents and adults, can be made to abort the direction society is moving with regards to the legalization of recreational marijuana.

### Myth: Marijuana is Not Addictive

A growing myth among the public is that marijuana is not an addictive substance. Data clearly show that about 10% of those who use cannabis become addicted; this number is higher among adolescents.<sup>26</sup> Users who seek treatment for marijuana addiction average 10 years of daily use.<sup>27</sup> A withdrawal syndrome has been described, consisting of anxiety, restlessness, insomnia, depression, and changes in appetite<sup>28</sup> and affects as many as 44% of frequent users,<sup>29</sup> contributing to the addictive potential of the drug.



There is some evidence that compounds naturally found in marijuana have therapeutic benefit for symptoms of diseases such as HIV/AIDS, multiple sclerosis, and cancer. If these compounds are to be used under the auspices of ‘medical marijuana,’ they should undergo the same rigorous approval process that other medications prescribed by physicians, including randomized, placebo- and active-controlled trials to evaluate safety and efficacy, not by popular vote or state legislature.

This addictive potential may be less than that of opiates; but the belief, especially among adolescents, that the drug is not addictive is misguided.

### Schizophrenia and Other Psychotic Disorders

Marijuana has been consistently shown to be a risk factor for schizophrenia and other psychotic disorders.<sup>30-32</sup> The association between marijuana and schizophrenia fulfills many, but not all, of the standard criteria for the epidemiological establishment of causation, including experimental evidence,<sup>33,34</sup> temporal relationship,<sup>35-38</sup> biological gradient,<sup>30,31,39</sup> and biological plausibility.<sup>40</sup> Genetic variation may explain why marijuana use does not strongly fulfill remaining criteria, such as strength of association and specificity.<sup>41,42</sup> As these genetic variants are explored and further characterized, marijuana use may be shown to cause or precipitate schizophrenia in a genetically

vulnerable population. The risk of psychotic disorder is more pronounced when marijuana is used at an earlier age.<sup>32, 43</sup>

### Effects on Cognition

Early studies suggested cognitive declines associated with marijuana (especially early and heavy use); these declines persisted long after the period of acute cannabis intoxication.<sup>44-46</sup> Recently, Meier and colleagues analyzed data from a prospective study which followed subjects from birth to age 38; their findings yielded supportive evidence that cannabis use, when begun during adolescence, was associated with cognitive impairment in multiple areas, including executive functioning, processing speed, memory, perceptual reasoning, and verbal comprehension.<sup>47</sup> Rogeberg<sup>48</sup> criticized the study’s methodology, claiming that the results were confounded by differences in socioeconomic status; this claim, however, was based on sub-analyses that used very small numbers. Additional sub-analyses<sup>49</sup> of the original study cohort showed that marijuana was just as prevalent in populations of higher

socioeconomic status, suggesting that socioeconomic status was not a confounding variable. Any epidemiological study is subject to confounding biases and future research will be needed to clarify and quantify the relationship between cognitive decline and adolescent marijuana use. However, the findings of the original study by Meier et al show there is indeed an independent relationship between loss of intelligence and adolescent marijuana use. This finding, moreover, is consistent with prior studies.<sup>44</sup>

### Other Negative Health Effects

Substantial evidence exists suggesting that marijuana is harmful to the respiratory system. It is associated with symptoms of obstructive and inflammatory lung disease,<sup>11,50</sup> an increased risk of lung cancer,<sup>14,15</sup> and it is suspected to be associated with reduced pulmonary function in heavy users.<sup>51</sup> Further, its use has been associated with harmful effects to other organ systems, including the reproductive,<sup>52</sup> gastrointestinal,<sup>53</sup> and immunologic<sup>10, 54</sup> systems.

### Social Safety Implications: Effects on Driving

Marijuana impairs the ability to judge time, distance, and speed; it slows reaction time and reduces ability to track moving objects.<sup>55,56</sup> In many studies of drug-related motor vehicle fatalities, marijuana is the most common drug detected except for alcohol.<sup>57,58</sup> Based on post-mortem studies, Couch et al determined that marijuana was likely an impairing factor in as many fatal accidents as alcohol.<sup>59</sup> One study showed that in motor vehicle accidents where the driver was killed, recent marijuana use was detected in 12% of cases.<sup>57</sup> Other research confirms a significantly increased risk of motor vehicle fatalities in association with acute cannabis intoxication.<sup>60</sup>

### Risk Perception and Use in Adolescents

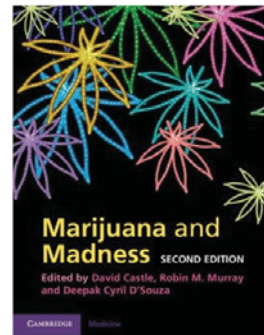
Marijuana use among adolescents has been increasing. Data that has tracked risk perception and use of marijuana among adolescents over decades clearly shows an inverse relationship; as adolescent risk perception wanes, marijuana use increases.<sup>61</sup> As more states legalize medical and recreational marijuana, risk perception is expected to decrease, causing the prevalence of use among adolescent to continue to rise. This is among the most concerning of issues about the drug's legalization because so many of the negative effects of marijuana—including cognitive impairment and risk for short- and long-term psychosis—are heightened when used during adolescence.



BOOK REVIEW

### Marijuana and Madness

Editors: David Castle, Robin M. Murray,  
Deepak Cyril D'Souza



A comprehensive overview of the psychiatry and neuroscience of *Cannabis sativa* (marijuana). It outlines the latest developments in understanding the human cannabinoid system, and links this knowledge to clinical and epidemiological facts about the impact of cannabis on mental health. Clinically focused chapters review not only the direct psychomimetic properties of cannabis, but also the impact consumption has on the courses of evolving or established mental illnesses such as schizophrenia. Effects of cannabis on mood are reviewed, as are its effects on cognition.

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### Conclusion

There is some evidence that compounds naturally found in marijuana have therapeutic benefit for symptoms of diseases such as HIV/AIDS, multiple sclerosis, and cancer. If these compounds are to be used under the auspices of 'medical marijuana,' they should undergo the same rigorous approval process that other medications prescribed by physicians, including randomized, placebo- and active-controlled trials to evaluate safety and efficacy, not by popular vote or state legislature. Furthermore, these therapeutic compounds should be administered via a route that minimizes long-term health risk (i.e., via oral pill) and should be dispensed by centrally regulated pharmacies to ensure the purity and concentration of the drug and allow for the recall of contaminated batches.

Marijuana for recreational use will have many adverse health effects. The drug is addictive, with mounting evidence for the existence of a withdrawal syndrome. Furthermore, it has been shown to have adverse effects on mental health, intelligence (including irreversible declines in cognition), and the respiratory system. Driving while acutely intoxicated with marijuana greatly increases the risk of fatal motor vehicle collision. Legalization for recreational use may have theoretical (but still unproven) beneficial social effects regarding issues such as domestic criminal justice policy, but these effects will not come without substantial public health and social costs. Currently there is a lack of resources devoted to educating physicians about this most commonly used illicit substance. The potential



benefits and significant risks associated with marijuana use should be taught in medical schools and residency programs throughout the country.

## References

- Gloss D, Vickrey B. Cannabinoids for epilepsy. *The Cochrane database of systematic reviews* 2012;13.
- Lutge EE, Gray A, Siegfried N. The medical use of cannabis for reducing morbidity and mortality in patients with HIV/AIDS. *The Cochrane database of systematic reviews* 2013;4:CD005175.
- Soderpalm AH, Schuster A, de Wit H. Antiemetic efficacy of smoked marijuana: subjective and behavioral effects on nausea induced by syrup of ipecac. *Pharmacology, biochemistry, and behavior* 2001;69:343-50.
- Richards BL, Whittle SL, Buchbinder R. Neuromodulators for pain management in rheumatoid arthritis. *The Cochrane database of systematic reviews* 2012;1:CD008921.
- Krishnan S, Cairns R, Howard R. Cannabinoids for the treatment of dementia. *The Cochrane database of systematic reviews* 2009:CD007204.
- Mills RJ, Yap L, Young CA. Treatment for ataxia in multiple sclerosis. *The Cochrane database of systematic reviews* 2007:CD005029.
- Verweij PE, Kerremans JJ, Voss A, Meis JF. Fungal contamination of tobacco and marijuana. *JAMA*. 2000 Dec 13;284(22):2875.
- Gongidi P, Sarkar D, Behling E, Brody J. Cerebral phaeohyphomycosis in a patient with neurosarcoïdosis on chronic steroid therapy secondary to recreational marijuana usage. *Case Rep Radiol* 2013;191375:21.
- Cescon DW, Page AV, Richardson S, Moore MJ, Boerner S, Gold WL. Invasive pulmonary aspergillosis associated with marijuana use in a man with colorectal cancer. *Journal of clinical oncology : official journal of the American Society of Clinical Oncology* 2008;26:2214-5.
- Svrakic DM, Lustman PJ, Mallya A, Lynn TA, Finney R, Svrakic NM. Legalization, decriminalization & medicinal use of cannabis: a scientific and public health perspective. *Missouri Medicine* 2012;109:90-8.
- Tetraault JM, Crothers K, Moore BA, Mehra R, Concato J, Fiellin DA. Effects of marijuana smoking on pulmonary function and respiratory complications: a systematic review. *Archives of internal medicine* 2007;167:221-8.
- Watson SJ, Benson JA, Jr, Joy JE. Marijuana and medicine: assessing the science base: a summary of the 1999 Institute of Medicine report. *Archives of general psychiatry* 2000;57:547-52.
- Wu TC, Tashkin DP, Djahed B, Rose JE. Pulmonary hazards of smoking marijuana as compared with tobacco. *The New England journal of medicine* 1988;318:347-51.
- Sasco AJ, Merrill RM, Dari I, et al. A case-control study of lung cancer in Casablanca, Morocco. *Cancer causes & control : CCC* 2002;13:609-16.
- Aldington S, Harwood M, Cox B, et al. Cannabis use and risk of lung cancer: a case-control study. *The European respiratory journal* 2008;31:280-6.
- Hashibe M, Morgenstern H, Cui Y, et al. Marijuana use and the risk of lung and upper aerodigestive tract cancers: results of a population-based case-control study. *Cancer epidemiology, biomarkers & prevention : a publication of the American Association for Cancer Research, cosponsored by the American Society of Preventive Oncology* 2006;15:1829-34.
- Nussbaum AM, Boyer JA, Kondrad EC. "But my doctor recommended pot": medical marijuana and the patient-physician relationship. *Journal of general internal medicine* 2011;26:1364-7.
- Nunberg H, Kilmer B, Pacula RL, Burgdorf J. An Analysis of Applicants Presenting to a Medical Marijuana Specialty Practice in California. *Journal of drug policy analysis* 2011;4.
- Ellis RJ, Toperoff W, Vaida F, et al. Smoked medicinal cannabis for neuropathic pain in HIV: a randomized, crossover clinical trial. *Neuropsychopharmacology : official publication of the American College of Neuropsychopharmacology* 2009;34:672-80.
- Abrams DI, Jay CA, Shade SB, et al. Cannabis in painful HIV-associated sensory neuropathy: a randomized placebo-controlled trial. *Neurology* 2007;68:515-21.
- Wilsey B, Marcotte T, Tsodikov A, et al. A randomized, placebo-controlled, crossover trial of cannabis cigarettes in neuropathic pain. *J Pain* 2008;9:506-21.
- Selvarajah D, Gandhi R, Emery CJ, Tesfaye S. Randomized placebo-controlled double-blind clinical trial of cannabis-based medicinal product (Sativex) in painful diabetic neuropathy: depression is a major confounding factor. *Diabetes care* 2010;33:128-30.
- Leroux E, Taïfas I, Valade D, Donnet A, Chagnon M, Ducros A. Use of cannabis among 139 cluster headache sufferers. *Cephalalgia : an international journal of headache* 2013;33:208-13.
- Kraft B, Frickey NA, Kaufmann RM, et al. Lack of analgesia by oral standardized cannabis extract on acute inflammatory pain and hyperalgesia in volunteers. *Anesthesiology* 2008;109:101-10.
- Buggy DJ, Toogood L, Marie S, Sharpe P, Lambert DG, Rowbotham DJ. Lack of analgesic efficacy of oral delta-9-tetrahydrocannabinol in postoperative pain. *Pain* 2003;106:169-72.
- Kandel D, Chen K, Warner LA, Kessler RC, Grant B. Prevalence and demographic correlates of symptoms of last year dependence on alcohol, nicotine, marijuana and cocaine in the US population. *Drug and alcohol dependence* 1997;44:11-29.
- Maldonado R, Berrendero F, Ozaita A, Robledo P. Neurochemical basis of cannabis addiction. *Neuroscience* 2011;181:1-17.
- Budney AJ, Hughes JR. The cannabis withdrawal syndrome. *Current opinion in psychiatry* 2006;19:233-8.
- Hasin DS, Keyes KM, Alderson D, Wang S, Aharonovich E, Grant BF. Cannabis withdrawal in the United States: results from NESARC. *The Journal of clinical psychiatry* 2008;69:1354-63.
- Moore TH, Zammit S, Lingford-Hughes A, et al. Cannabis use and risk of psychotic or affective mental health outcomes: a systematic review. *Lancet* 2007;370:319-28.
- Manrique-García E, Zammit S, Dalman C, Hemmingsson T, Andreasson S, Allebeck P. Cannabis, schizophrenia and other non-affective psychoses: 35 years of follow-up of a population-based cohort. *Psychological medicine* 2012;42:1321-8.

- Arseneault L, Cannon M, Witton J, Murray RM. Causal association between cannabis and psychosis: examination of the evidence. *The British journal of psychiatry : the journal of mental science* 2004;184:110-7.
- D'Souza DC, Fridberg DJ, Skosnik PD, et al. Dose-related modulation of event-related potentials to novel and target stimuli by intravenous Delta(9)-THC in humans. *Neuropsychopharmacology : official publication of the American College of Neuropsychopharmacology* 2012;37:1632-46.
- D'Souza DC, Perry E, MacDougall L, et al. The psychotomimetic effects of intravenous delta-9-tetrahydrocannabinol in healthy individuals: implications for psychosis. *Neuropsychopharmacology : official publication of the American College of Neuropsychopharmacology* 2004;29:1558-72.
- Linszen DH, Dingemans PM, Lenior ME. Cannabis abuse and the course of recent-onset schizophrenic disorders. *Archives of general psychiatry* 1994;51:273-9.
- Dragt S, Nieman DH, Schultze-Lutter F, et al. Cannabis use and age at onset of symptoms in subjects at clinical high risk for psychosis. *Acta psychiatrica Scandinavica* 2012;125:45-53.
- Cunha PJ, Rosa PG, Ayres Ade M, et al. Cannabis use, cognition and brain structure in first-episode psychosis. *Schizophrenia research* 2013;147:209-15.
- Schimmelmann BG, Conus P, Cotton SM, et al. Cannabis use disorder and age at onset of psychosis—a study in first-episode patients. *Schizophrenia research* 2011;129:52-6.
- Henquet C, Krabbendam L, Spauwen J, et al. Prospective cohort study of cannabis use, predisposition for psychosis, and psychotic symptoms in young people. *BMJ (Clinical research ed)* 2005;330:11.
- D'Souza DC, Sewell RA, Ranganathan M. Cannabis and psychosis/schizophrenia: human studies. *European archives of psychiatry and clinical neuroscience* 2009;259:413-31.
- Di Forti M, Iyegbe C, Sallis H, et al. Confirmation that the AKT1 (rs2494732) genotype influences the risk of psychosis in cannabis users. *Biol Psychiatry* 2012;72:811-6.
- van Winkel R. Family-based analysis of genetic variation underlying psychosis-inducing effects of cannabis: sibling analysis and proband follow-up. *Archives of general psychiatry* 2011;68:148-57.
- Trezza V, Cuomo V, Vanderschuren LJ. Cannabis and the developing brain: insights from behavior. *European journal of pharmacology* 2008;585:441-52.
- Solowij N, Stephens RS, Roffman RA, et al. Cognitive functioning of long-term heavy cannabis users seeking treatment. *JAMA : the journal of the American Medical Association* 2002;287:1123-31.
- Pope HG, Jr, Yurgelun-Todd D. The residual cognitive effects of heavy marijuana use in college students. *JAMA : the journal of the American Medical Association* 1996;275:521-7.
- Fletcher JM, Page JB, Francis DJ, et al. Cognitive correlates of long-term cannabis use in Costa Rican men. *Archives of general psychiatry* 1996;53:1051-7.
- Meier MH, Caspi A, Ambler A, et al. Persistent cannabis users show neuropsychological decline from childhood to midlife. *Proceedings of the National Academy of Sciences of the United States of America* 2012;109:E2657-64.
- Rogeberg O. Correlations between cannabis use and IQ change in the Dunedin cohort are consistent with confounding from socioeconomic status. *Proceedings of the National Academy of Sciences of the United States of America* 2013;110:4251-4.
- Moffitt TE, Meier MH, Caspi A, Poulton R. Reply to Rogeberg and Daly: No evidence that socioeconomic status or personality differences confound the association between cannabis use and IQ decline. *Proceedings of the National Academy of Sciences of the United States of America* 2013;110:E980-2.
- Moore BA, Augustson EM, Moser RP, Budney AJ. Respiratory effects of marijuana and tobacco use in a U.S. sample. *Journal of general internal medicine* 2005;20:33-7.
- Pletcher MJ, Vittinghoff E, Kalkan R, et al. Association between marijuana exposure and pulmonary function over 20 years. *JAMA : the journal of the American Medical Association* 2012;307:173-81.
- Kolodny RC, Masters WH, Kolodner RM, Toro G. Depression of plasma testosterone levels after chronic intensive marijuana use. *The New England journal of medicine* 1974;290:872-4.
- Sullivan S. Cannabinoid hyperemesis. *Canadian journal of gastroenterology = Journal canadien de gastroenterologie* 2010;24:284-5.
- Friedman H, Newton C, Klein TW. Microbial infections, immunomodulation, and drugs of abuse. *Clinical microbiology reviews* 2003;16:209-19.
- Heyman RB, Anglin TM, Copperman SM, et al. American Academy of Pediatrics. Committee on Substance Abuse. Marijuana: A continuing concern for pediatricians. *Pediatrics* 1999;104:982-5.
- Kurzthaler I, Hummer M, Miller C, et al. Effect of cannabis use on cognitive functions and driving ability. *The Journal of clinical psychiatry* 1999;60:395-9.
- Schwilke EW, Sampaio dos Santos MI, Logan BK. Changing patterns of drug and alcohol use in fatally injured drivers in Washington State. *J Forensic Sci* 2006;51:1191-8.
- Logan BK, Schwilke EW. Drug and alcohol use in fatally injured drivers in Washington State. *J Forensic Sci* 1996;41:505-10.
- Crouch DJ, Birky MM, Gust SW, et al. The prevalence of drugs and alcohol in fatally injured truck drivers. *J Forensic Sci* 1993;38:1342-53.
- Asbridge M, Hayden JA, Cartwright JL. Acute cannabis consumption and motor vehicle collision risk: systematic review of observational studies and meta-analysis. *BMJ (Clinical research ed)* 2012;344:e536.
- Kleber HD, DuPont RL. Physicians and medical marijuana. *Am J Psychiatry* 2012;169:564-8.

## Disclosure

None reported.

