Letter to the Editor

MEDICAL MARIJUANA, NOT MIRACLE MARIJUANA: SOME WELL-PUBLICIZED STUDIES ABOUT MEDICAL MARIJUANA DO NOT PASS A REALITY CHECK

For the past few years, one of the most popular topics in major journals and media outlets has been how medical marijuana use improves health outcomes [1]. Studies have found that medical marijuana laws (MMLs) are responsible for a 25% decrease in opioid overdose rates [2], a 2.1% reduction in the probability of obesity [3], a 10–20% reduction in Medicaid and Medicare prescriptions [4,5] and a 15% reduction in alcohol sales [6]. In major news outlets, the study authors and reporters conclude that these findings are evidence of the healthful effects of medical marijuana use [7–9].

Unfortunately, these effects are probably too grand to even possibly be ascribed to medical marijuana use. Simply put, medical marijuana use is probably not prevalent enough to account for any one of these effects, let alone all of them.

According to the National Survey on Drug Use and Health (NSDUH) [10], in 2013–2015 the prevalence of medical marijuana users (i.e. any marijuana use recommended by a health professional) in MML states was approximately 2.5% [95% confidence interval (CI) = 2.3–2.8%]. A population this small could not reasonably move health metrics as dramatically as these past studies suggest.

Consider the finding that alcohol sales decreased 15% in MML states [6]. Annual US alcohol sales are approximately $210 billion, so a 15% reduction would represent ~$32 billion. To account for this change, medical marijuana users would have to be giving up, on average, $4800 of alcohol every year. Assuming a linear relationship between alcohol sales and volume consumed, that translates to 3000 fewer drinks per user, per year (eight to nine drinks per user, per day).

Consider further the finding that medical marijuana laws were associated with a reduction of an average of 0.162 body mass index (BMI) points [3]. If that drop is the effect of medical marijuana use, each user would have to lose, on average, 6.5 BMI points. For reference, for a 5′10″ 150-pound male to lose 6.5 BMI points, he would have to lose 45 pounds. If, as the paper concluded, medical marijuana use caused the population probability of obesity in MML states to decrease by 2.1% and obesity-related health costs to decrease $86.5/person, then users' likelihood of obesity must have declined 84% and their obesity-related medical costs by $3,400 per year.

It is unlikely that there is a population unhealthy enough to even possibly have these kinds of health improvements, let alone a single treatment that could cause them. Further, medical marijuana users are not particularly unhealthy. According to the NSDUH, about 40% of medical marijuana users are under 50, and more than half self-report to be in good overall health. The average weight of medical marijuana users is 177.0 pounds (compared to 175.2 lbs for non-users) and the average BMI is 26.3 (26.8 for non-users).

Further, these reality checks assume that medical marijuana users only gained access to marijuana through MMLs. That assumption seems overly conservative; the proportion of people in MML states who only use marijuana medically is 1.7%, so many medical marijuana users also use recreational marijuana. That some medical marijuana users exist in non-MML states (0.5%) indicates many had access to medical marijuana before MML were implemented.

The more probable explanation for these results is methodological flaws, such as the ecological fallacy [10–13]—a nuanced error in which authors mistake correlations on the population-level for effects on the individual level. For example, the ecological fallacy explains why areas with more smoking can have lower cancer rates [14]. The ecological fallacy is present in every one of the aforementioned studies, but ecological fallacy criticisms are often brushed aside in pursuit of an enticing headline.

The better approach to understanding the medical benefits of marijuana is to use studies that follow individuals instead of states [1]. Until then, researchers should not let the medical marijuana narrative overtake the science—these headline findings crumble under even the most basic reality checks. Unless we are ready to believe that medical marijuana is a miracle, it is time to return to the drawing board.

THEODORE L. CAPUTI iD

Drug Policy Institute, College of Medicine, University of Florida,
Gainesville, Florida, USA
E-mail: tcaputi@gmail.com

References

1. Hall W., West R., Marsden J., Humphreys K., Neale J., Petry N. It is premature to expand access to medicinal cannabis in hopes of solving the US opioid crisis. *Addiction* 2018; **113**: 987–8.

2. Bachhuber M. A., Saloner B., Cunningham C. O., Barry C. L. Medical cannabis laws and opioid analgesic overdose mortality in the United States, 1999–2010. *JAMA Intern Med* 2014; **174**: 1668–73.

3. Sabia J. J., Swigert J., Young T. The effect of medical marijuana laws on body weight. *Health Econ* 2017; **26**: 6–34.

4. Bradford A. C., Bradford W. D. Medical marijuana laws reduce prescription medication use in medicare part D. *Health Aff* 2016; **35**: 1230–6.

5. Bradford A. C., Bradford W. D. Medical marijuana laws may be associated with a decline in the number of prescriptions for Medicaid enrollees. *Health Aff* 2017; **36**: 945–51.

6. Baggio M, Chong A, Kwon S. Marijuana and Alcohol Evidence Using Border Analysis and Retail Sales Data [internet]. Rochester, NY: Social Science Research Network; 2018 Aug [cited 2019 Jan 26]. Report no.: ID 3063288 Available at: http://papers.ssrn.com/abstract=3063288 (accessed 4 February 2019) (Archived at http://www.webcitation.org/76SxnyjBk).

7. Bachhuber M, Barry C. Of pot and percocet. New York Times [internet]. 2014 Aug 29 [cited 2019 Jan 26]; Available at: https://www.nytimes.com/2014/08/31/opinion/sunday/of-pot-and-percocet.html (accessed 4 February 2019) (Archived at http://www.webcitation.org/76SxpFmEX).

8. Luthra S. After medical marijuana legalized, medicare prescriptions drop for many drugs. NPR [internet]. 2016 Jul 6 [cited 2019 Jan 26]; Available at: https://www.npr.org/sections/health-shots/2016/07/06/484977159/after-medical-marijuana-legalized-medicare-prescriptions-drop-for-many-drugs (accessed 4 February 2019) (Archived at http://www.webcitation.org/76SxtgbiB).

9. Ingraham C. Medical marijuana took a bite out of alcohol sales. Recreational pot could take an even bigger one. The Washington Post [internet]. 2017 Dec 1 [cited 2019 Jan 26]; Available at: https://www.washingtonpost.com/news/wonk/wp/2017/12/01/medical-marijuana-took-a-bite-out-of-alcohol-sales-recreational-pot-could-take-an-even-bigger-one/?noredirect=on&utm_term=.8b43d6537584 (accessed 4 February 2019) (Archived at http://www.webcitation.org/76SxvTyGd).

10. Caputi T. L., Humphreys K. Medical marijuana users are more likely to use prescription drugs medically and nonmedically. *J Addict Med* 2018; **12**: 295–9.

11. Caputi T. L., Humphreys K. Medicare recipients' use of medical marijuana. *Health Aff* 2016; **35**: 1936–1936.

12. Caputi T. L., Sabet K. A. Population-level analyses cannot tell us anything about individual-level marijuana-opioid substitution. *Am J Public Health* 2018; **108**: e12–e12.

13. Humphreys K, Saitz R. Should physicians recommend replacing opioids with cannabis? JAMA [internet]. 2019 Feb 1 [cited 2019 Feb 4]; Available at: https://jamanetwork.com/journals/jama/article-abstract/2723649 (accessed 4 February 2019) (Archived at http://www.webcitation.org/76clcW0oQ).

14. Cohen B. L. A test of the linear-no threshold theory of radiation carcinogenesis. *Environ Res* 1990; **53**: 193–220.