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Commentary

The Devil Is in the Details! On Regulating Cannabis Use in Canada Based on Public Health Criteria

Comment on "Legalizing and Regulating Marijuana in Canada: Review of Potential Economic, Social, and Health Impacts"

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Abstract
This commentary to the editorial of Hajizadeh argues that the economic, social and health consequences of legalizing cannabis in Canada will depend in large part on the exact stipulations (mainly from the federal government) and on the implementation, regulation and practice of the legalization act (on provincial and municipal levels). A strict regulatory framework is necessary to minimize the health burden attributable to cannabis use. This includes prominently control of production and sale of the legal cannabis including control of price and content with ban of marketing and advertisement. Regulation of medical marijuana should be part of such a framework as well.
Keywords: Cannabis, Marijuana, Health Burden, Legalization, Regulation, Production, Sale, Medical Marijuana

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The Current Situation in Canada: Waiting for a Federal Legalization Framework

Canada will become one of the first countries to fully legalize cannabis consumption on a national level (as announced at the United Nations General Assembly Special Session on drugs 2016),[1] and Hajizadeh[2] tries to summarize the potential economic, social and health consequences of such a move. We will argue here that all of these consequences will depend in large part on the exact stipulations (mainly from the federal government) and on the implementation, regulation and practice of the legalization act on provincial and municipal levels (for similar considerations for the United States see).[3,4] The federal government's point person on the legalization of marijuana has declared that legalization would be implemented within a public health framework,[5] and he spoke about strict controls (for a general overview on regulation and public health).[6,7] However, even with such a framework there are different options, and further, the provinces will likely be given some latitude to regulate legal cannabis. The devil will be in the details.

As a general background, substance policies matter.[8] Psychoactive substance use is among the leading risk factors for global burden of disease,[9] and the last decades have shown that wrong policies may even lead to reversals in the monotonous upward trends of life expectancy that characterized most of the last century.[10,11] The importance for public health of getting substance policies right has been shown in regards to legal substances,[12,13] illegal substances,[14]

and pharmaceuticals[10] (for more general discussions see [8,10,15]). There are also economic costs to society, which depend on the policies implemented,[16] and these costs affect not only the healthcare system but also the educational, legal, and other systems.[17,18] The mere fact of whether a substance use is legal or not does not predict the resulting burden of disease, and consequently, legalization may result in negative or positive health outcomes, depending on how the legal and regulatory framework is designed and implemented.

Given the above background and the situation in Canada, the current contribution has two main objectives. First, we will give an overview of how regulations and implementation may impact on the main behavioural drivers of cannabis-related harm. Second, we give a few examples of how the details of these regulations may impact on the actual outcomes.

Cannabis-Related Health Harms and Policy

As cannabis use *per se* in a legalized framework has no criminal consequences, we need to establish regulations which would reduce the cannabis use behaviours linked to most of the health burden. This current health burden mainly comprises cannabis use disorders as the most important non-fatal health outcome, and injury fatalities, especially traffic injury fatalities[19] as the most important mortality outcome (for a quantification for Canada see[20,21]). The most important behaviours linked to burden are the following (see also[21]):

- Heavy use/frequent use over time[22,23]
- Mixing of cannabis use and operating machinery (in

particular driving a car)[24,25]
- Using cannabis with high tetrahydrocannabinol (THC)[26]
- Smoking cannabis, especially mixed with tobacco[22]
- Using cannabis in early and mid-adolescence[26,27]

How could regulation play a role in reducing these behaviours? Education and guidelines may play a role in reducing heavy and frequent use (for guidelines see[22]). One way to finance such efforts would be via a dedicated tax, which would be used for prevention, research, education, and treatment. Examples of such taxes exist in the alcohol and tobacco field,[28] and justification could be derived from classical economic theory.[29,30] Another way to impact on frequency of use, especially in adolescents (above legal age) and young adults, is via price (and indirectly via taxation). Alcohol and tobacco policies have shown that price is a powerful tool to influence level of use,[31,32] and specific taxation schemes may even impact on onset of substance use.[33,34] Finally, again drawing from alcohol and tobacco, a ban on marketing and advertisement contributes to establish cannabis as no ordinary commodity where certain caution in use patterns are required.[15]

Mixing cannabis use and driving (or operating machinery) should be avoided independently of the policy environment. Even though there had been studies showing no significant results of cannabis use on driving,[35] systematic reviews of all relevant studies and subsequent pooling of results show an impact,[24,25] and the biological pathways on reaction time and psychomotor coordination are similar between operating a car and other machinery.[19,36] Thus, *per se* laws similar to the ones governing blood alcohol level to prevent such behaviour (ie, no driving or operating machinery with active levels of Δ^9-tetrahydrocannabinol which could impair reaction time and psychomotor coordination) should be established.[37,38]

Using cannabis in early and mid-adolescence poses specific health risks,[26,27] including risk on the developing brain. Thus, a minimum purchasing age needs to be implemented similar to alcohol[39] (which has similar or even more detrimental effects[40]). Moreover, this laws needs to be well-enforced, and experience with alcohol has shown that best enforcement can be achieved can be achieved through a state monopoly on sales.[39]

Using cannabis with high tetrahydrocannabinol content is becoming more common in some countries,[41] and the effects on health (compared to lower THC) can be more detrimental.[19,26] Obviously, THC content can and should be regulated in legalized environments, similar to regulated ingredients in food, alcoholic beverages or other legal substances. This could take the form of pricing policies that make higher-potency products are more expensive than those with lower potency.

Smoking cannabis, especially with tobacco, adds additional risk, especially with respect to respiratory disease.[19] Again, there should be more education on these specific risks, and there should be encouragement of smoke-free and tobacco-free modes of cannabis use in a legalized environment.

Furthermore, there may be some short-term public health consequences of legalization related to cannabis-related emergency department visits,[42,43] which may be avoided with specific implementations (see recent proposed changes in Colorado as listed in[43]).

… and Further Details

The above examples show that regulation can contribute to a reduction in behaviours which have been associated with health harm. However, things are not that simple. Much will depend on controlling the way the legal substance is produced and sold (and we will restrict the following discussion to the latter point).

For cannabis another complication comes into play, which does not exist for other legal psychoactive substances like alcohol or tobacco: medical use.[44] Medical marijuana programs have proliferated in the United States and Canada,[45] in part because they allowed higher availability of an illegal substance without changing narcotic laws. Depending on the jurisdiction, some of the usual regulatory principles of pharmaceutical product approval are not required, with the consequence that cannabis is frequently prescribed for conditions where its effect is not clear[46] or may even be detrimental, such as depression or anxiety disorders.[47-49] In a regulated legal environment, medical use of cannabis should be restricted to disorders where clear evidence of effectiveness has been established through the same rigorous process of approval as other pharmaceuticals, usually via a series of phases ending with randomized controlled trials in humans to establish efficacy in treating certain conditions.[50] This would ensure avoidance of problems such as mis-indications as mentioned above. It should be stated that medical research with cannabis has historically faced barriers in the United States,[51] but this is not an issue in Canada.

Even if these principles are adhered to, there is a question of what should happen to currently established cannabis dispensaries in the interim, or in the long run. The controversy in Toronto after the recent police raids of illegal dispensaries provides some illustration.[52] In these controversies, some argued that no police action should be have been taken because cannabis will be legalized within less than a year, while others maintained that they were justified because the dispensaries violate the current law for medical marijuana. In addition, the type of dispensaries setting up shop in Toronto may not have a place in the new legal framework, but their presence (and increasing numbers) is creating facts on the ground. The longer this persists, the more challenging it will be for the federal government's preferred legal cannabis framework to succeed.

Again, the situation is not entirely historically new as illegal producers and sellers of alcohol had to be integrated into a new system after the prohibition of alcohol was lifted in North America. This worked quite well, and moonshine and other illicitly produced alcohol currently play little role in either Canada or the United States.[53] The creation of a state monopoly that offers market prices to producers may be a solution here, which had worked for unrecorded alcohol in Germany at the time.[54]

Thus, while the debate on legalization of cannabis has often been categorical between its proponents and adversaries, the true challenge will be the exact implementation. If Canada does not get these regulations correct, public health problems may be created, with subsequent costs to society, which may exceed the new tax revenues.[16] On the other hand, if regulations are carefully introduced based on best available evidence (and admittedly some of this evidence will come

from other fields),[55] with independent monitoring and surveillance, and with openness to change in case of negative developments, Canada has a chance to become a leader as an experimenting society.[56-58]

Ethical issues
Not applicable.

Competing interests
Authors declare that they have no competing interests.

Authors' contributions
JR wrote the drafts for the original and revised version of the commentary. All authors significantly contributed to the text, and have approved of the final version.

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References
1. Government of Canada. Plenary statement for the Honourable Jane Philpott Minister of Health – UNGASS on the world drug problem. http://news.gc.ca/web/article-en.do?nid=1054489 Accessed 06/06/2016. Published 2016.
2. Hajizadeh M. Legalizing and regulating marijuana in Canada: review of potential economic, social, and health impacts. *Int J Health Policy Manag.* 2016;5:1-4. doi:10.15171/ijhpm.2016.63
3. Caulkins JP, Kilmer B, Kleinman MA, et al. Options and isses regarding marijuana legalization: Rand Corporation; 2015: http://www.rand.org/pubs/perspectives/PE149.html. Accessed Accessed August 12, 2016.
4. Caulkins JP, Kilmer B, Kleinman MA, et al. *Considering marijuana legalization: Insights for Vermont and other jurisdictions*. Santa Monica, CA: Rand Corporation; 2015.
5. LeBlanc D. Legalizing marijuana will come with strict controls, MP Bill Blair says. *The Globe and Mail.* January 12, 2016. http://www.theglobeandmail.com/news/politics/legalizing-marijuana-will-come-with-strict-controls-mp-bill-blair-says/article28137320/.
6. Crépault JF, Rehm J, Fischer B. Cannabis policy framework by the centre for addiction and mental health: a proposal for a public health approach to cannabis policy in Canada. *Int J Drug Policy.* 2016; forthcoming. doi:10.1016/j.drugpo.2016.04.013
7. Centre for Addiction and Mental Health. *Cannabis Policy Framework.* Toronto, Canada: Centre for Addiction and Mental Health; 2014.
8. Rehm J, Anderson P, Fischer B, Gual A, Room R. Policy implications of marked reversals of population life expectancy caused by substance use. *BMC Med.* 2016; 14:42. doi:10.1186/s12916-016-0590-x
9. Forouzanfar MH, Alexander L, Anderson HR, et al. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study

2013. *Lancet.* 2015;386(10010):2287-2323. doi:10.1016/S0140-6736(15)00128-2
10. Deaton A. *The Great Escape – health, wealth and the origins of inequality*. Princeton, NJ: Princeton University Press; 2013.
11. Riley JC. *Rising Life Expectancy: A Global History*. Cambridge, UK: Cambridge University Press; 2001.
12. Leon DA, Chenet L, Shkolnikov V, et al. Huge variation in Russian mortality rates 1984-1994: artefact, alcohol, or what? *Lancet.* 1997; 350(9075):383-388.
13. Bhattacharya J, Gathmann C, Miller G. The Gorbachev Anti-Alcohol Campaign and Russia's Mortality Crisis. *Am Econ J Appl Econ.* 2013;5(2):232-260.
14. Aburto JM, Beltrán-Sánchez H, García-Guerrero VM, Canudas-Romo V. Homicides in Mexico reversed life expectancy gains for men and slowed them for women, 2000-10. *Health Aff.* 2016;35(1):88-95. doi:10.1377/hlthaff.2015.0068
15. Anderson P, Braddick F, Conrod P, et al. *The New Governance of Addictive Substances and Behaviours*. Oxford, UK: Oxford University Press; 2016.
16. Kilmer B, Caulkins JP, Pacula RL, MacCoun RJ, Reuter PH. *Altered state? Assessing How Marijuana Legalization in California Could Influence Marijuana Consumption and Public Budgets*. Santa Monica, CA: RAND Corporation; 2010.
17. MacQueen K. Why it's time to legalize marijuana. http://www.macleans.ca/news/canada/why-its-time-to-legalize-marijuana/. Accessed August 12, 2016. Published 2013.
18. Shanahan M, Ritter A. Cost benefit analysis of two policy options for cannabis: status quo and legalisation. *PLoS One.* 2014;9(4):e95569. doi:10.1371/journal.pone.0095569
19. World Health Organization (WHO). *The health and social effects of nonmedical cannabis use*. Geneva, Switzerland: WHO; 2016.
20. Fischer B, Imtiaz S, Rudzinski K, Rehm J. Crude estimates of cannabis-attributable mortality and morbidity in Canada–implications for public health focused intervention priorities. *J Public Health.* 2016;38(1):183-188. doi:10.1093/pubmed/fdv005
21. Imtiaz S, Shield KD, Roerecke M, et al. The burden of disease attributable to cannabis use in Canada in 2012. *Addiction.* 2016;111:653-662.
22. Fischer B, Jeffries V, Hall W, Room R, Goldner E, Rehm J. Lower risk cannabis use guidelines for Canada (LRCUG): a narrative review of evidence and recommendations. *Can J Public Health.* 2011;102(5):324-327.
23. Rehm J, Marmet S, Anderson P, et al. Defining substance use disorders: do we really need more than heavy use? *Alcohol Alcohol.* 2013;48(6):633-640. doi:10.1093/alcalc/agt127
24. Asbridge M, Hayden JA, Cartwright JL. Acute cannabis consumption and motor vehicle collision risk: systematic review of observational studies and meta-analysis. *Br Med J* 2012344:e536. doi:10.1136/bmj.e536
25. Rogeberg O, Elvik R. The effects of cannabis intoxication on motor vehicle collision revisited and revised. *Addiction.* 2016;111(8):1348-1359. doi:10.1111/add.13347
26. Volkow ND, Baler RD, Compton WM, Weiss SR. Adverse health effects of marijuana use. *N Engl J Med.* 2014;370(23):2219-2227. doi:10.1056/NEJMra1402309
27. George T, Vaccarino F. *Substance abuse in Canada: the effects of cannabis use during adolescence*. Ottawa, ON: Canadian Centre on Substance Abuse; 2015.
28. Chaloupka FJ, Yurekli A, Fong GT. Tobacco taxes as a tobacco control strategy. *Tob Control.* 2012;21:172-180. doi:10.1136/tobaccocontrol-2011-050417
29. Thomas B. Issues in the design of excise tax. *J Econ Perspect.* 1994;8(1):133-151.
30. Pigou AC. *The Economics of Welfare*. London: Macmillan; 1920.
31. Chisholm D, Doran C, Shibuya K, Rehm J. Comparative cost-effectiveness of policy instruments for reducing the global

burden of alcohol, tobacco and illicit drug use. *Drug Alcohol Rev.* 2006; 25(6):553-565.

32. U.S. Department of Health and Human Services. *The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General.* Atlanta, GA: Department of Health and Human Services. Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion. Office on Smoking and Health; 2014.

33. Freedman KS, Nelson NM, Feldman LL. Smoking initiation among young adults in the United States and Canada, 1998-2010: a systematic review. *Prev Chronic Dis.* 2012;9:E05.

34. Sornpaisarn B, Shield KD, Cohen JE, Schwartz R, Rehm J. Can pricing deter adolescents and young adults from starting to drink: an analysis of the effect of alcohol taxation on drinking initiation among Thai adolescents and young adults. *J Epidemiol Glob Health.* 2015;5(Suppl 4):S45-S57.

35. National Highway Traffic Safety Administration. NHTSA releases two new studies on impaired driving on U.S. roads. 2015. http://www.nhtsa.gov/About+NHTSA/Press+Releases/2015/nhtsa-releases-2-impaired-driving-studies-02-2015. Accessed June 1, 2016.

36. Volkow ND, Swanson JM, Evins AE, et al. Effects of cannabis use on human behavior, including cognition, motivation, and psychosis: a review *JAMA Psychiatry.* 2016; 73(3):292-297. doi:10.1093/schbul/sbv010

37. World Health Organization (WHO). *Global status report on road safety 2015.* Geneva, Switzerland: WHO; 2015.

38. Wong K, Brady JE, Li G. Establishing legal limits for driving under the influence of marijuana. *Inj Epidemiol.* 2014;1:26. doi:10.1186/s40621-014-0026-z

39. Babor T, Caetano R, Casswell S, et al. *Alcohol: No ordinary commodity. Research and public policy.* 2nd ed. Oxford: Oxford University Press; 2010.

40. Squeglia LM, Jacobus J, Tapert SF. The influence of substance use on adolescent brain development. *Clin EEG Neurosci.* 2009;40(1):31-38.

41. Mehmedic Z, Chandra S, Slade D, et al. Potency trends of Delta9-THC and other cannabinoids in confiscated cannabis preparations from 1993 to 2008. *J Forensic Sci.* 2010;55(5):1209-1217. doi:10.1111/j.1556-4029.2010.01441.x

42. Davis JM, Mendelson B, Berkes JJ, Suleta K, Corsi KF, Booth RE. Public health effects of medical marijuana legalization in Colorado. *Am J Prev Med.* 2016;50(3):373-379. doi:10.1016/j.amepre.2015.06.034

43. Wang GS, Le Lait MC, Deakyne SJ, Bronstein AC, Bajal L, Roosevelt G. Unintentional pediatric exposures to marijuana in Colorado, 2009-2015. *JAMA Pediatr.* 2016;e160971. doi:10.1001/jamapediatrics.2016.0971.

44. Leung L. Cannabis and its derivatives: review of medical use. *The Journal of the American Board of Family Medicine.* 2011;24(4):452-462.

45. ProCon. 25 Legal marjuana states and DC - Laws, fees, and possession limits. 2016. http://medicalmarijuana.procon.org/view.resource.php?resourceID=000881#summary. Accessed June 27, 2016.

46. Walsh Z, Callaway R, Belle-Isle L, et al. Cannabis for therapeutic purposes: Patient characteristics, access, and reasons for use. *Int J Drug Policy.* 2013;24:511-516.

47. Feingold D, Weiser M, Rehm J, Lev-Ran S. The association between cannabis use and mood disorders: A longitudinal study. *Journal of Affective Disorder.* 2015; 1(172):211-218. doi:10.1016/j.jad.2014.10.006

48. Lev-Ran S, Roerecke M, Le Foll B, George TP, McKenzie K, Rehm J. The association between cannabis use and depression: a systematic review and meta-analysis of longitudinal studies. *Psychol Med.* 2014;44(4):797-810. doi:10.1017/s0033291713001438

49. 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(9584):319-328. doi:10.1016/s0140-6736(07)61162-3

50. Health Canada. How drugs are reviewed in Canada. http://www.hc-sc.gc.ca/dhp-mps/prodpharma/activit/fs-fi/reviewfs_examenfd-eng.php. Accessed June 1, 2016. Published 2015.

51. Stith SS, Vigil JM. Federal barriers to Cannabis research. *Science.* 2016; 352(6290):1182. doi:10.1126/science.aaf7450

52. CBC News. Second round of pot shop raids as police descend on city dispensaries. 2016. http://www.cbc.ca/news/canada/toronto/second-round-of-pot-shop-raids-as-police-descend-on-city-dispensaries-1.3649510. Accessed June 27, 2016.

53. Rehm J, Kailasapillai S, Larsen E, et al. A systematic review of the epidemiology of unrecorded alcohol consumption and the chemical composition of unrecorded alcohol. *Addiction.* 2014;109(5):880-893. doi:10.1111/add.12498

54. Lachenmeier DW, Rehm J. Von Schwarzbrennern und Vieldrinkern. Die Auswirkungen des deutschen Branntweinmonopols auf den gesundheitlichen Verbraucherschutz. [Bootleggers and heavy drinkers. The impact of the German alcohol monopoly on public health and consumer safety]. *Sucht.* 2010;56(2):91-93.

55. Pacula RL, Kilmer B, Wagenaar AC, Chaloupka FJ, Caulkins JP. Developing public health regulations for marijuana: Lessons from alcohol and tobacco. *Am J Public Health.* 2014;104(6):1021-1028.

56. Campbell DT. Reforms as experiments. *American Psychologist.* 1969;24:409-429.

57. Campbell DT. The social scientist as methodological servant of the experimenting society. *Policy Stud J.* 1973;2:72-75.

58. Fischer B, Rehm J, Crépault JF. Realistically furthering the goals of public health by cannabis legalization with strict regulation: Response to Kalant. *Int J Alcohol Drug Res.* 2016. pii: S0955-3959(16)30196-7. doi:10.1016/j.drugpo.2016.06.014