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Viewpoint

Potential public health impacts of medical cannabis availability on opioid-related harms? Urgent but un-answered questions from Canada

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Canada, just like the United States (US), faces a persistent public health crisis of opioid-related morbidity and mortality, following exceptionally high opioid availability, since the early 2000s (Fairbairn, Coffin, & Walley, 2017; Kolodny et al., 2015; Belzak & Halverson, 2018). In 2017, there were a reported 3998 opioid-related deaths (Canada) and 47,600 opioid-related deaths (US), respectively, entailing similar mortality rates as well as reductions in adult life expectancy in both countries (Government of Canada, 2019b; Belzak & Halverson, 2018; Scholl, Seth, Kariisa, Wilson, & Baldwin, 2019). For considerable time, North American jurisdictions have sought effective ways to reduce the opioid-related disease burden in their populations. While some indicators of opioid-related harms have improved (e.g., non-medical use, treatment engagement) mortality outcomes have persistently increased in Canada, especially as recently accelerated by an expanding toxic, illicit opioid supply (Ciccarone, 2017; Fischer, Rehm, & Tyndall, 2016; Gomes et al., 2018). Hence, effective measures and interventions to stem the opioid crisis are more urgently needed than ever (Fischer, Rehm & Tyndall, 2016).

Recently, several – mainly US-based ecological studies – have reported population-level associations between medical cannabis use/availability (e.g., through state-based access programs) and opioid-related harms (Campbell, Hall, & Nielsen, 2018; Powell, Pacula, & Jacobson, 2018). Concretely, lower increases in opioid-related mortality and morbidity (e.g., injuries), and lower levels of opioid use were identified in a variety of (e.g., US state) populations with greater medical cannabis availability (Bachhuber, Saloner, Cunningham, & Barry, 2014; Bradford & Bradford, 2016; Bradford, Bradford, Abraham, & Adams, 2018; Kim et al., 2016; Shi, 2017; Wen & Hockenberry, 2018). Furthermore, convenience samples of medical cannabis users surveyed have self-reported reduced use of or risks related to (legal or illegal) opioids or other psychoactive drugs in the context of medical cannabis use (Corroon, Mischley, & Sexton, 2017; Lucas & Walsh, 2017; Reiman, Welty, & Solomon, 2017). These data have resulted in vocal advocacy for expansions of medical cannabis access and utilization in

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response to the opioid crisis (Lau et al., 2015; Lucas, 2017). However, while medical cannabis access provisions as well as opioid-related mortality harms are common in several other countries (Abuhasira, Shbiro, & Landschaft, 2018; European Monitoring Centre for Drugs & Drug Addiction, 2018; Martin & Bonomo, 2016; Roxburgh et al., 2017), empirical analyses on correlations between these indicators to date are predominantly limited to US-based data.

Unfortunately, no systematic examinations of associations between medical cannabis access and opioid-related mortality exist in Canada. This is surprising given both Canada's high opioid-related disease burden as well as its long-existent (since 2001), national, government-sponsored medical cannabis access program (Belle-Isle et al., 2014; Fischer, Kuganesan, & Room, 2015). The basic parameters of the (federal) regulatory framework of Canada's medical cannabis program have evolved substantially in scope and structure since its inception and over the nearly two decades of its existence. Under the initial regulations, individuals seeking formal access for medical cannabis use were required to make an application to and receive approval by federal authorities; possible access was initially limited to a select list of severe medical indications. Recent fundamental revisions to the regulations (Marihuana for Medical Purposes Regulations [MMPR], 2014) now require medical cannabis users to obtain endorsement (practically equivalent to a prescription, possible for any health condition for which possible benefit from medical cannabis use is expected) from a medical professionals and – with some exceptions - to receive their medical cannabis product supply mainly from 'Licensed Producers' (Belle-Isle et al., 2014; Fischer et al., 2015). While formally not a legal source, many medical cannabis users have been sourcing their cannabis products from community-based 'dispensaries' which have proliferated across Canada, and in anticipation of the legalization of non-medical cannabis use and supply (implemented in Canada in October 2018). While uptake was low in earlier years, Canada's medical cannabis access program has enrolled increasing numbers of sanctioned users totalling > 350,000 individuals, or ˜1.25% of Canada's adult population, by early 2019 (Government of Canada, 2019a). Unfortunately, as for other key substance use and health outcomes, there are limited surveillance data publicly available on this program, curtailing the potential for systematic evaluation (Fischer, Gooch, Goldman, Kurdyak, & Rehm, 2014).

Within these distinct parameters, and in order to examine possible signals for associations between levels of medical cannabis access and opioid-related mortality observed in some US jurisdictions, we identified both the numbers of opioid-related deaths and individuals registered for medical cannabis use by province/territory in Canada in 2017 based on federally reported data. These data, at the time of writing, were not consistently available for other years. We computed population-based rates (per 100,000) for each dataset, and generated a scatter plot of the two indicators by province, including a line-of-best-fit [see Fig. 1]. We found a very small positive (0.097) but non-significant correlation (multiple R-squared: 0.009417; F(1,10) 0.09507; p-value: 0.7642) between population-level rates of medical cannabis utilization and opioid-related mortality by province.

Our admittedly rudimentary (cross-sectional) analysis did not find for Canada indications for the negative associations reported by several studies between medical cannabis availability and opioid-related mortality levels in US jurisdictions. However, the data examined feature several limitations compromising their interpretability. First, they include only a very small number of data points, crucially limiting statistical power. Ideally, there would be sufficient multiple over-time datapoints on the outcome indicators of interest to facilitate time-series methods of analysis. Second, there are large inter-provincial differences across Canada in opioid mortality rates – varying by more than a factor of ten which likely reflect both differences in opioid use cultures and related addiction and overdose response systems – yet also in rates of medical cannabis utilization through the federal access program. These latter rates, almost certainly, mis-estimate the actual extent of medical cannabis use for at least two reasons within the current context of blurred distinctions between medical and non-medical cannabis use. Concretely, some proclaimed 'medical users' may subjectively present their cannabis use as principally 'medical' and thereby instrumentalize medical provisions for convenient cannabis access. At the same time, many other individuals using cannabis principally for therapeutic purposes may simply access cannabis outside the formal purview of medical access provisions, especially in environments of liberal cannabis access contexts where this is easily feasible (as has been the case for much of Canada in recent years leading up to non-medical cannabis legalization; Fischer, Rehm, & Crépault, 2016). To empirically illustrate such possible discrepancies: While 114,000 registered medical cannabis users were documented for the province of Ontario in 2017, general population survey data estimated that 766,000 individuals (one-third of active of cannabis users) reported using cannabis for "medical purposes" in that year (Ialomiteanu, Hamilton, Adlaf, & Mann, 2018).

In conclusion, available national data in Canada offer only inadequate and unduly limited opportunity to scientifically examine possible associations between medical cannabis availability and opioid-related related harms (e.g., mortality) outcomes. This is despite the persistent opioid-related mortality crisis in North America, and the urgent need for improved, evidence-based interventions to address, for which medical cannabis utilization has been suggested – and controversially discussed – as a possibly beneficial measure (Finney, Humphreys, & Harris, 2015; Fischer, Pang, & Tyndall, 2018; Powell et al., 2018). The two, uniquely co-occurring phenomena in Canada provide a distinct 'natural experiment' scenario for systematic empirical assessment of whether medical cannabis access may indeed facilitate a reduction of population-level opioid-related harms. The current data and analysis limitations are particularly unfortunate since Canada features both organizational and empirical resources – including unique population-level health utilization and outcomes datasets from federal and provincial levels – as well as regulatory tools to enable such data assessments towards these objectives (as has been done in other instances; see for example; Canadian Institutes for Health Information, 2017). In the present case, systematic analyses would involve the availability – and ideally include matched population linkage for comparison – of over-time population data on medical cannabis access and opioid-related fatalities. Alternatively, such analyses could be conducted with a focus on provincial populations and data, utilizing – readily available – provincial overtime data on opioid-related mortality (see, for example, for Ontario: Gomes, Greaves, & Marties, 2017; Gomes et al., 2018) combined with corresponding provincial medical cannabis user population data. The availability of these data if desired can be leveraged and provided based on active support and joint efforts from relevant federal and provincial agencies with respective mandates (e.g., Health Canada/Public Health Agency of Canada, Canadian Institutes of Health Information, Institute for Clinical Evaluative Sciences or equivalent analytic entities in other provinces).

In sum, in light of recent findings elsewhere, Canada urgently should facilitate adequate mobilization and analysis of national data to examine the possible impacts of medical cannabis utilization on persistent opioid-related mortality and other harms in the face of the ongoing public health crisis. Such analyses could furthermore benefit other (e.g., non-North American) jurisdictions seeking evidence-based options to inform their intervention strategies to prevent similarly catastrophic crises of opioid harms as the one persistently raging in North America.

Author contributions

BF conceptualized the paper and prepared the initial draft. WJ conducted the statistical analyses. All authors reviewed and provided intellectual contributions to and revised content of several drafts of the paper. All authors approved the final manuscript submitted.

Jurisdiction	No. of opioid deaths	Rate of opioid deaths	No. of medical cannabis registrations	Rate of medical cannabis registrations
British Columbia	1,482	30.11	9,985	20.29
Alberta	745	17.55	104,272	245.69
Saskatchewan	75	6.52	8,601	74.74
Manitoba	106	7.94	6,650	49.80
Ontario	1,265	8.99	110,338	78.41
Quebec	181	2.18	7,318	8.82
New Brunswick	36	4.69	6,524	85.08
Nova Scotia	63	6.63	11,539	121.38
Prince Edward Island	4	2.66	1,194	79.30
Newfoundland and Labrador	33	6.24	2,747	51.97
Yukon	7	17.66	118	29.78
Northwest Territories	1	2.23	154	34.27
Nunavut	NA	NA	62	16.51
CANADA	3,998	10.94	269,502	73.75

Data Sources: [1] Health Canada (available: https://www.canada.ca/en/health-canada/services/drugs-medication/cannabis/licensed-producers/market-data.html); [2] Health Canada. (available: https://www.canada.ca/en/health-canada/services/substance-use/problematic-prescription-drug-use/opioids/data-surveillance-research/harms-deaths.html); [3] Statistics Canada. (available: https://www150.statcan.gc.ca/n1/en/subjects/population_and_demography);

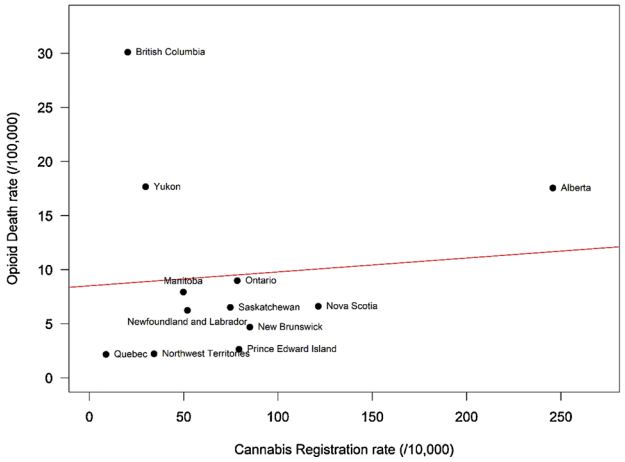

Fig. 1. Numbers and Rates, including Scatter Plot of Opioid-related Deaths and Medical Cannabis Registrations, Canada and Provinces/Territories, 2017.

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