Original article

The costs and benefits of cannabis control policies

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As is the case for most drugs, cannabis use has costs and benefits, and so do the policies that attempt to minimize the first and maximize the second. This article summarizes what we know about the harmful effects of recreational cannabis use and the benefits of medical cannabis use under the policy of prohibition that prevailed in developed countries until 2012. It outlines three broad ways in which cannabis prohibition may be relaxed, namely, the depenalization of personal possession and use, the legalization of medical use, and the legalization of adult recreational use. It reviews evidence to date on the impacts of each of these forms of liberalization on the costs and benefits of cannabis use. It makes some plausible conjectures about the future impacts of the commercialization of cannabis using experience from the commercialization of the alcohol, tobacco, and gambling industries. Cannabis policy entails unavoidable trade-offs between competing social values in the face of considerable uncertainty about the effects that more liberal cannabis policies will have on cannabis use and its consequences for better or worse.

Dialogues Clin Neurosci. 2020;22(3):281-287. doi:10.31887/DCNS.2020.22.3/whall

Keywords: adverse effect; cannabis policy; legalization; public health impact

Introduction

Since at least 1961, countries that have signed the United Nations drug conventions have prohibited adult cannabis use on the assumptions that its use can seriously harm users and that it does not have any medical uses.[1] Critics of this policy[2] have argued that the adverse effects of cannabis use have been overestimated and its medical benefits underestimated.

A prohibition on adult cannabis use has probably reduced the prevalence and duration of cannabis use in young adulthood,[3] but these benefits have come with costs.[4] These include the costs of enforcing the criminal law against cannabis users and producers (eg, police, courts, and prisons) and the adverse effects that criminal records have on the minority of cannabis users who come to police attention. In some countries, in some periods, cannabis users have been imprisoned or more often, suffered the stigma and adverse effects of having a criminal conviction or an arrest record. These burdens have disproportionately affected socially disadvantaged ethnic minorities.[2]

Our knowledge of the harm caused by cannabis use is incomplete, and interpretations of the evidence are often contested.[5,6] So is our understanding of the medical and other benefits of cannabis use.[6,7] The lack of good epidemiological and clinical data has made it difficult to assess the costs and benefits of cannabis use to users and the whole population.

Most of our knowledge of the adverse effects of cannabis use comes from studies in high-income countries (HICs), such as the United States (US), Australia, New Zealand, and Canada, that have prohibited cannabis.[3] These studies have shown that the adverse health effects of cannabis under prohibition are modest by comparison with those of alcohol, tobacco, and the opioids.[8,9]

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Acute harm

The acute adverse effects of cannabis use include an increased risk of road crashes, if users drive while intoxicated.[5,6] The risk of a road crash is smaller for cannabis-impaired than alcohol-impaired drivers because drivers who have used cannabis are less impaired and take fewer risks by virtue of being more aware that they are impaired.[5,6]

A minority of cannabis users have very unpleasant psychological experiences, such as severe anxiety, palpitations, and psychotic symptoms. These experiences may be distressing enough to prompt them to seek medical help.[6]

Women of reproductive age who use cannabis during their pregnancies may reduce their babies' birth weight[5] and have poorer birth outcomes.[6] Their children may be more likely to experience behavioral problems in childhood, although it is less certain that cannabis is a cause of these outcomes because of the limited ability of these studies to control for confounders.[10]

Health effects of regular cannabis use: dependence and its correlates

The daily use of cannabis increases the risk of cannabis dependence, a disorder in which users find it difficult to control their cannabis use, even when they recognize that it is harming them.[11] Cannabis dependence is a common reason for seeking addiction treatment in many HICs, in a substantial proportion under legal coercion.[5] Treatment seeking for cannabis use is not, however, solely a consequence of prohibition: cannabis dependence is a common reason for treatment seeking in the Netherlands where criminal penalties for cannabis use and small-scale retail sales have not been enforced since the 1970s.[12]

Cannabis dependence is associated with a number of adverse psychosocial outcomes.[13] These include the following: mental disorders, such as psychoses and depressive and anxiety disorders; the use of other illicit drugs; cognitive impairment; poor educational outcomes; and antisocial behavior, such as violence. There is a debate about whether cannabis use is a contributory cause of all these outcomes and whether some of the associations are better explained by residual confounding, or cannabis being used for self-medication.[5]

There is reasonably convincing evidence that daily cannabis use that is initiated in early adolescence can bring forward the onset of psychoses in persons with a personal or family history of psychiatric disorder.[14] Persons who develop psychoses and continue to use cannabis daily have poorer outcomes.[15]

Regular cannabis use is associated with poorer cognitive performance in young people.[16] The cognitive impairment is most evident while young people are using cannabis daily, as a substantial minority do throughout adolescence. Young people who perform poorly in primary school are more likely to become regular cannabis users, but it is probable that daily cannabis use adversely affects their educational outcomes by impairing their performance in school and leading to early school leaving.[17]

It is less clear why daily cannabis use is associated with depression and anxiety disorders.[18] The relative risks are modest and reverse causation has not been excluded.[19] It is plausible that young people use cannabis, like alcohol, to self-medicate their low mood and anxiety, and that this miscarries in that their cannabis use becomes their way of coping with low mood. This may lead to the development of tolerance and withdrawal symptoms on cessation. Cannabis dependence may then become comorbid with a depressive or anxiety disorder, worsening its course, and making it more difficult for young people to develop better ways of coping with their low mood.

The long-term health effects of regular cannabis use

The effects of daily cannabis use over decades on the risks of cancer and heart disease are poorly understood[5,6] in part because few cannabis users have engaged in daily use over decades under prohibition. Estimates[20] of the contribution of cannabis use to the global burden of disease (GBD) do not include any long-term adverse health effects for this reason. The GBD estimates suggest that cannabis use has much smaller impacts on disease burden than alcohol, tobacco, heroin, and cocaine in HICs and indicate that its largest impacts are attributable to cannabis dependence and road crashes.[21]

The benefits of cannabis use under prohibition

The positive effects that cannabis users report include relaxation, anxiety reduction, increased sociability, and an enhanced appreciation of nature, music, food, and sex.[6] According to classical economics, users' preparedness to pay for cannabis and risk arrest and criminal penalties for

using it indicates that it has benefits. A substantial proportion of cannabis users appear to derive pleasure from their cannabis use[22] while experiencing a minimum of harm.

There is moderate evidence that Δ^9-tetrahydrocannabinol (THC) can relieve muscle spasms in multiple sclerosis and reduce nausea and vomiting in patients receiving chemotherapy for cancer.[6] There is much weaker evidence that cannabis use reduces chronic pain, the most common reason for medical use in the US.[23] In clinical trials, THC is only marginally superior to placebo: 24 people need to receive cannabis rather than placebo for one to benefit over placebo (number needed to treat or NNT), and only 6 need to be treated for one to show side effects over those receiving placebo (number needed to harm or NNH).[24]

> Few of the governments that have legalized cannabis have funded the research needed to evaluate the effects of the policy

The potential costs and benefits of cannabis use under more liberal policies

Three popular arguments in favor of legalizing adult cannabis use are: that its adverse health effects are modest compared with those of other licit and illicit drugs; that criminal penalties for cannabis use harm users and the community; and that legalization enables cannabis to be better regulated and taxed.[2,3] Opponents counter that legalization will increase cannabis-related harm by increasing the number of adolescents who use and the number of young adults who become daily users.[25]

The major challenge in estimating the probable net effect of legalization on the costs and benefits of cannabis use is a lack of recent historical experience with legal cannabis markets. Cannabis use has been prohibited for the past 80 years in most countries, and it was not widely used before prohibition, even in countries such as India that have a long history of traditional use.[1]

A major determinant of the costs of cannabis use under more liberal cannabis policies is how it affects the proportion of the population who use cannabis daily over years and decades.[3] Liberal cannabis policies may also increase the number of new cannabis users who derive medical benefits, or pleasure, from using cannabis without experiencing harm.

The risk:benefit ratio of cannabis use will depend on how liberally governments regulate its use and supply. The policies available to government for liberalization of prohibition can be discussed under three broad headings: (i) removing criminal penalties for personal use while retaining the prohibition on commercial cannabis supply; (ii) the legalization of cannabis for medical use only; and (iii) the legalization of adult cannabis use. Finer, more nuanced cannabis policies can also be distinguished,[26] but these variations have not played a major role in debates about the design of cannabis policies in the US states that have liberalized.

Depenalization of personal possession and use

Depenalization removes criminal penalties for possession and use of cannabis but does not legalize the production and sale of cannabis. It can be achieved by diverting cannabis users who are arrested into treatment or counseling, or by changing the law to remove criminal penalties for personal use, and either have no penalty or only a modest fine, like those that apply to minor traffic offences.[1]

The experience over the past several decades in Australia, the Netherlands, France, Portugal, and some states in the US has been that depenalization does not markedly increase rates of cannabis use.[1] It leaves cannabis supply to the illicit market, which keeps cannabis prices high and probably means that cannabis use retains some of the stigma of being illicit.[3] It is a mark of the change in the policy zeitgeist that 20 years ago depenalization was considered a radical policy; it is now advocated by those who oppose cannabis legalization.[25]

The legalization of medical cannabis use

Governments may legislate to allow patients to use cannabis for medical purposes.[7] In the strictest regulatory approach, patients can only use approved cannabis-based medicines, ie, cannabis-based medicines produced to pharmaceutical standards and that have been approved for use because there is good evidence of their safety and effectiveness

in controlled clinical trials. Governments who take this path face a number of major challenges, namely, a lack of approved medical cannabis products for doctors to prescribe; the reluctance of physicians to prescribe unapproved cannabinoids; and the high cost to patients of using approved cannabis medicines.[7]

Patients can have easier access to medical cannabis under more liberal regulations, eg, those that authorize medical use with minimal medical oversight and that allow the retail sale of cannabis-based medicines that do not meet the standards required for pharmaceutical products.[7] The implementation of this approach in the US and Canada has led to the de facto legalization of adult cannabis use by allowing any adult to use cannabis if they have paid a prescriber to certify that they have a medical condition that would benefit from using cannabis. The frequency of cannabis use and possibly the prevalence of cannabis use and dependence has increased among adults in US states with liberal medical cannabis laws, but use does not appear to have increased among adolescents in these states.[27]

Liberal medical cannabis laws have facilitated the passage of referenda to legalize adult cannabis use in a number of US states.[28] Pro-cannabis advocates have been successful at the state level at persuading electors that cannabis use causes little harm and has manifold medical benefits.[28] The latter claim is largely supported by patient testimonials instead of the type of evidence drug regulators require to approve a drug for medical use.

In the past, reports of harm associated with cannabis use were often uncritically embraced as providing support for a continuation of prohibition; today, equivocal evidence of medical benefits is used to justify more liberal medical cannabis policies (eg, ref 29). Evidential double standards are exemplified in the very different evaluations made of observational evidence on the benefits and adverse effects of cannabis use.[30] The critics who discount observational evidence of harm from cannabis use because it is difficult to exclude uncontrolled confounding are often quick to accept much weaker evidence of benefits from ecological studies (eg, ref 29).

Arguments for the legalization of adult cannabis use

Until the mid-2010s, the majority of the US public supported cannabis prohibition.[31] Since then, support for legalizing adult cannabis use has increased, and in 2011 it had majority support. Three arguments seem to have brought about the change in public opinion.[32,33]

The first argument is that cannabis is less harmful than alcohol and tobacco use and a great deal less harmful than the use of heroin, cocaine, and methamphetamine. The second is that criminal penalties imposed on young adults who use cannabis cause more harm than their cannabis use, and they have been unfairly imposed on African-American and Latino youth. The third is that legalization is a better policy than prohibition because it reduces the costs of enforcing criminal laws and the incarceration of minority cannabis users, enables cannabis to be regulated in ways that protect public health, and generates taxes that could be used for worthwhile social purposes.[34]

Cannabis legalization in the United States

The legalization of adult cannabis use is a more honest policy than the de facto legalization of adult use under liberal medical cannabis regulation. Legalization removes all criminal penalties for personal cannabis use and allows the production and sale of cannabis to adults.[1,22] The most common approach in the US and Canada has been to regulate cannabis like alcohol use by licensing producers, processors, and retailers and allowing them to operate for profit.[3] This is of public health concern because many would argue that this approach to alcohol regulation has not effectively protected public health or preserved public order.[35]

Cannabis legalization in US states has led to a 50% fall in cannabis prices and to substantial increases in the potency of cannabis products via the sale of high-THC-content cannabis extracts and oils.[36] Profits from retail sales have also created a legal industry that is now lobbying to reduce cannabis taxes and other regulations in order to displace the illicit cannabis market. Investment by the alcohol and tobacco industries (so far confined to Canada) is likely to expand the size of the cannabis market and the number of daily cannabis users.[3]

So far, there has only been a small increase in adult cannabis use after legalization, but it would be unwise to assume that there will not be larger increases in the future. To date, the implementation of state legalization in the US has been constrained because a continuation of federal cannabis prohibition has limited the commercialization of the

cannabis industry. Local governments in many states have also restricted the number and location of retail outlets.[3] As argued in detail elsewhere, we may not be able to fully assess the public health impacts of cannabis legalization for a decade or more.[37]

Kleiman has argued that the implementation of cannabis legalization in the US has combined the worst effects of prohibition with those of legalization.[38] On the one hand, the introduction of legalization at the state level via citizen initiatives has prevented the federal regulation of cannabis products or sales in the interests of public safety. On the other hand, a continuation of prohibition in the majority of US states has created opportunities for criminal entrepreneurs to expand the illicit market, as shown in a recent outbreak of serious lung injuries caused by vaping illicit cannabis oils.[39,40]

Can cannabis be legalized in ways that better protect public health?

Cannabis need not be produced and sold for profit. It could be produced under state license and sold by a state monopoly or produced for a nonprofit cooperative[41] such as a cannabis growers' club. Uruguay has attempted to restrict the legal supply of cannabis in these ways by limiting the number of cannabis producers and only allowing registered cannabis users to grow their own cannabis, join a cannabis growers' club, or purchase cannabis that is produced under state license from pharmacies[42,43] at a price set by the government.[3,42] It is unclear whether these forms of legal access have replaced the illicit cannabis market. Less than half of the estimated cannabis users in Uruguay have registered with the state and many of them continue to buy cannabis from the illicit market.[3]

Canada has enacted a public health–oriented approach to the legalization of cannabis use and sale. For example, it has banned cannabis advertising, mandated plain packaging, and introduced taxes based upon the THC content of cannabis products.[44] Guidelines for lower-risk cannabis use have been disseminated to advise cannabis users about how to minimize the adverse health risks of cannabis use.[45]

Canadian cannabis policies also allow provinces to choose either a for-profit cannabis industry or a state monopoly (in those provinces that have state alcohol monopolies). So far, very few provinces have chosen the second option. State alcohol monopolies have been weakened in Ontario and dismantled in some US states (eg, Washington state).[35] The fact that public utilities (eg, water and power) and services (health, education, and prisons) are increasingly privatized makes it less likely for a state cannabis monopoly to attract the required public and political support.

Even if a state cannabis monopoly were implemented, it would probably be dismantled in the longer run as a result of cannabis industry lobbying to privatize cannabis production and sales. This has been the fate of state gambling monopolies in many HICs, creating a very profitable industry that is often too large and powerful for governments to regulate in the public interest.[46,47]

Public health concerns about cannabis legalization

The major concern about the public health impact of adult cannabis legalization is that it will increase the prevalence of daily cannabis use and the harms arising from it. Foremost among these are road traffic crashes, cannabis dependence, and adverse psychosocial outcomes among adolescents who are daily users.[3] Cannabis retailers have an interest in expanding the proportion of the population who use daily because they account for 80% of their sales.[48] The industry is now marketing cannabis to nonusers and its lobbyists are promoting the allegedly manifold health and well-being benefits of cannabis use while discounting evidence of harm.[3]

There is also the worry that the adverse effects of cannabis legalization will be socially inequitable. Legalization will reduce social inequalities arising from unequal enforcement of criminal penalties for cannabis use; however, daily cannabis users, like problem gamblers, are overrepresented in the most socially disadvantaged members of the community.[47,49] The legalization of cheaper and more potent forms of cannabis products may increase the number of daily cannabis users in poorer communities to the economic detriment of users and their communities.

Choosing a cannabis policy

Designing a cannabis policy involves unavoidable tradeoffs between the goals of minimizing the harmful effects and maximizing the benefits of cannabis use, while minimizing any harm that arises from our efforts to regulate cannabis use, whether that is by criminalizing personal use

and cannabis supply or by legalizing its production and sale.[22,50] Devising a policy therefore requires policy makers to compromise between competing socially desirable goals, namely, protecting young people from the harmful effects of cannabis use by minimizing their access and use; minimizing the adverse public health and public order effects of cannabis use on adults; allowing adults to use cannabis for recreational purposes without interference by the state; and minimizing the social and economic costs of the policies intended to minimize use and harm.

These trade-offs have to be made in the face of considerable uncertainty about the harm and benefits of cannabis use under prohibition and the uncertainty about how more liberal cannabis policies will affect these harmful effects and benefits. Ideally, governments and citizens need to find out as soon as possible what the benefits and risks of cannabis legalization are. Unfortunately, few of the governments that have legalized cannabis have funded the research needed to evaluate the effects of the policy. Only Washington state has done so in the US. Canada has funded a national evaluation of the policy by Statistics Canada and provided funding for independent research studies (eg, ref 51).

By the time we have the data needed to assess the effects of cannabis legalization in Canada and the US, the policy will be difficult to reverse. It will also probably be more difficult to regulate the cannabis industry in the public interest because legalization will have created a large and powerful industry that generates tax revenue for governments and that has the funds to lobby for regulatory policies that enable them to expand their markets.[3] ■

Acknowledgments/Disclosures: The author would like to thank Sarah Yeates for her assistance in preparing this manuscript for publication.

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