

Research Paper

Assessing options for cannabis law reform: A Multi-Criteria Decision Analysis (MCDA) with stakeholders in New Zealand



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ABSTRACT

Background: A number of jurisdictions are considering or implementing different options for cannabis law reform, including New Zealand. Multi-Criteria Decision Analysis (MCDA) helps facilitate the resolution of complex policy decisions by breaking them down into key criteria and drawing on the combined knowledge of experts from various backgrounds.

Aims: To rank cannabis law reform options by facilitating expert stakeholders to express preferences for projected reform outcomes using MCDA.

Methods: A group of cannabis policy experts projected the outcomes of eight cannabis policy options (i.e., prohibition, decriminalization, social clubs, government monopoly, not-for-profit trusts, strict regulation, light regulation, and unrestricted market) based on five criteria (i.e., health and social harm, illegal market size, arrests, tax income, treatment services). A facilitated workshop of 42 key national stakeholders expressed preferences for different reform outcomes and doing so generated relative weights for each criterion and level. The resulting weights were then used to rank the eight policy options.

Results: The relative weighting of the criteria were: “reducing health and social harm” (46%), “reducing arrests” (31%), “reducing the illegal market” (13%), “expanding treatment” (8%) and “earning tax” (2%). The top ranked reform options were: “government monopoly” (81%), “not-for-profit” (73%) and “strict market regulation” (65%). These three received higher scores due to their projected lower impact on health and social harm, medium reduction in arrests, and medium reduction in the illegal market. The “lightly regulated market” option scored lower largely due to its projected greater increase in health and social harm. “Prohibition” ranked lowest due to its lack of impact on reducing the number of arrests or size of the illegal market.

Conclusion: Strictly regulated legal market options were ranked higher than both the current prohibition, and alternatively, more lightly regulated legal market options, as they were projected to minimize health and social harms while substantially reducing arrests and the illegal market.

Introduction

The enactment of recreational cannabis legalization in Uruguay, Canada and 18 U.S. states (plus Washington DC) has reignited the

international debate about the preferred policy approach to cannabis (Decorte, Lenton, & Wilkins, 2020a; European Monitoring Centre for Drugs and Drug Addiction (EMCDDA), 2020; Hall et al., 2019). In previous decades, a range of cannabis decriminalization regimes were enacted in over 30 countries, notably in the Netherlands, Portugal, Spain, Australia, and Germany (Eastwood, Fox, Rosmarin, 2016, Eastwood, 2020); however, further reform involving permitting legal production and retail sales remains controversial. In New Zealand, ac-

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tivism against the prohibition of cannabis and related enforcement operations, such as the annual cannabis crop eradication operation, has been going on for decades. Yet unlike neighboring Australia, where several states implemented cannabis decriminalization during the 1980s and 1990s (Hughes, 2020), the prohibition of cannabis has remained largely unchanged in New Zealand, apart from minor cannabis offences being included in a general criminal justice movement away from prosecution to use of diversion and formal warnings for minor offending (Wilkins & Sweetsur, 2012).

In 2017, the New Zealand Green Party, which had advocated for cannabis law reform for many years, secured a commitment to hold a referendum on the legal status of cannabis in New Zealand as part of its support for the new Labor government. A national referendum on a proposal to legalize recreational cannabis use and supply was held in 2020 (NZ Herald, 2017) and did not pass (Rychert & Wilkins, 2021). The New Zealand referendum was notable as it was the first to be held at the national level and to involve voting on a detailed proposal setting out a specific framework to establish a legal market for cannabis rather than a general question about whether cannabis should be legal or not (Wilkins & Rychert, 2020a). Despite the rejection of the legalization referendum, debate about the legal status of cannabis has continued in New Zealand and alternative proposals have been put forward (Wilson, 2020), including a petition to introduce decriminalization (Heatherington, 2020a,b).

Comparing different cannabis law reform options involves assessing multiple outcomes and trade-offs, and there are important gaps in data and lack of consensus regarding the longer term outcomes of different policy approaches or specific regulatory components (European Monitoring Centre for Drugs and Drug Addiction (EMCDDA), 2020; Fischer et al., 2020b; Hall et al., 2019; Leung et al., 2018; Leung et al., 2019; Smart & Pacula, 2019). Preliminary evaluations of recreational cannabis legalization in select U.S. states, Uruguay and Canada have concluded that it may take a decade or more to fully understand the consequences of legalization (European Monitoring Centre for Drugs and Drug Addiction (EMCDDA), 2020; Fischer et al., 2020b; Leung et al., 2018; Leung et al., 2019; Smart & Pacula, 2019). This inconclusiveness reflects a range of factors including time taken to establish retail cannabis outlets and markets; pre-existing cannabis trends and regimes for medicinal cannabis; slow evolving social norms related to cannabis use; time lags between cannabis use and a range of health and social outcomes, and yet to be felt impacts of the maturation of legal cannabis markets and related commercial industry (European Monitoring Centre for Drugs and Drug Addiction (EMCDDA), 2020; Leung et al. 2019; Smart & Pacula, 2019; Leung et al., 2018). The evaluation of cannabis legalization in U.S. states is further complicated by the continuing federal prohibition and related regulatory gaps and barriers to doing business. In addition, it has been recognized that how individuals and groups normatively value different cannabis reform objectives and outcomes influences their preferred reform option (Rogeberg, 2018, Wilkins et al., 2021).

Drug policy researchers have long pointed out there are a range of alternative ‘middle ground’ options to cannabis policy reform between prohibition on the one hand and unrestricted commercial markets on the other (Caulkins et al., 2015; Decorte et al., 2017; Decorte, Lenton, & Wilkins, 2020b; Queirolo, 2020; Queirolo et al., 2016; Rychert & Wilkins, 2019; Wilkins, 2018). These include home cultivation, social clubs, not-for-profit community trusts, government monopolies, heavily regulated markets and “for-benefit” companies (Caulkins & Kilmer, 2016; Decorte et al., 2017; Fischer et al., 2020a; Queirolo, 2020; Queirolo et al., 2016; Rychert & Wilkins, 2019; Wilkins, 2018, Barry et al., 2016, Barry et al., 2018, Cerda & Kilmer, 2017). However, these middle ground approaches have received less mainstream media and political attention than the familiar alcohol-style regimes implemented in U.S. states. This is the case even when middle ground approaches have been implemented for many years. For example, Uruguay passed a largely non-commercial supply system for recreational cannabis use in 2013, although it has taken some

time to establish the registration system and pharmacy retail supply (Queirolo, 2020).

Multi-Criteria Decision Analysis (MCDA) is a group decision-making method used to help resolve complex and controversial public policy decisions characterized by uncertainty and incomplete information (Department for Communities & Local Government, 2009). For example, it has been used to assess nuclear waste management and the risk-benefit ratio of prescription drugs (Hughes et al., 2016; Morton et al., 2009). MCDA has previously been employed in the drug policy field to assess the harms of different drug types and different policy approaches to drug access and control (Bonomo et al., 2019; Nutt et al., 2010; Rogeberg et al., 2018; van Amsterdam et al., 2015). MCDA allows decision-makers to break down complex problems into simpler and essential components, facilitates the combining and integrating of the knowledge of many decision-makers with a range of expertise, and supports collaborative problem-solving and consensus building, particularly where there is conflicting experiences or perspectives (Rogeberg et al., 2018). While MCDA has been utilized in the drug policy field, it is also acknowledged that the outcome of an MCDA analysis is influenced by the composition of the decision-making group (Rogeberg et al., 2018). MCDA of drug policies to date have largely involved small groups of health and academic experts. As a result, there have been calls for broadening these decision-making groups to provide wider perspectives on policy reform (Rogeberg et al., 2018; Rolles & Measham, 2011). The aim of this study was to inform the debate leading up to the New Zealand cannabis referendum by conducting an MCDA with a range of key national stakeholders to identify their preferences for cannabis reform outcomes and in doing so rank cannabis policy reform options.


Methodology

A central aim of our study was to involve a broader range of stakeholders in the MCDA assessment as suggested in recent critiques of MCDA. While these stakeholders possessed practical experience of different aspects of cannabis outcomes, they did not necessarily have detailed knowledge of the evidence related to the outcomes of cannabis policy reforms implemented overseas, or the wider research literature on the health and social risks of cannabis use. They also had limited time to digest this research literature and attend a multi-day decision-making workshop [previous MCDA workshops on drug policy have involved two-day meetings (e.g., Rogeberg et al., 2018; van Amsterdam et al., 2015)]. Consequently, to ensure as many stakeholders as possible were able to attend the workshop, much of the development of the MCDA model was completed in advance via a collaborative process with domestic and international cannabis policy experts (and the 1000minds™ MCDA software developers). This preliminary work allowed the MCDA workshop to be completed in a single day as stakeholder participants were able to go straight to normative trade-offs assessing projected outcomes from different reform options. From the perspective of the stakeholders, the MCDA was therefore largely a group discrete choice experiment where they were asked to make comparisons between two alternative projected outcomes that differed in a specified way on a key criterion (e.g., Fig. 1) and reach consensus on the preferred outcome.

Developing an MCDA model for evaluating cannabis policy reform options entails four broad stages: (1) defining the policy reform options, (2) specifying the decision-making criteria and their outcome levels, (3) determining the relative weights for the different decision-making criteria and related levels, and (4) ranking the policy reform options based on the relative weighting of the criteria and levels (Rogeberg et al., 2018).

Defining the policy reform options

The cannabis policy reform options in our MCDA included a number of “middle ground” approaches adapted to the New Zealand context

These boxes represent 2 outcomes related to possible cannabis policies ... Which one do you prefer? 

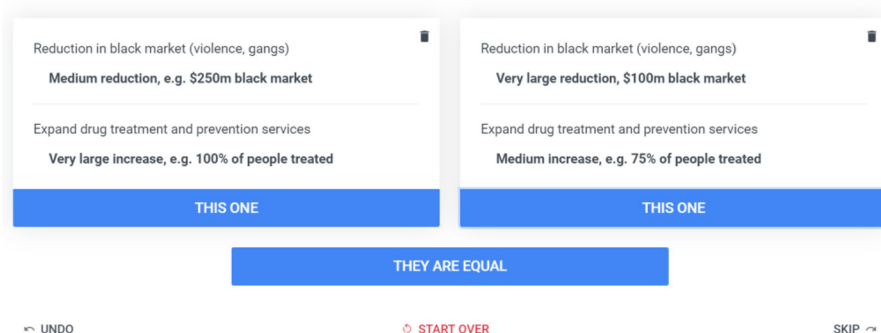


Fig. 1. Example of a trade-off question (1000minds screenshot).

Table 1
New Zealand cannabis policy reform options.

Reform option	Brief description
Prohibition with criminal penalties	Current New Zealand policy. Use and supply is a criminal offence with the possibility of conviction and in rare circumstances imprisonment
Prohibition with fines (“like a speeding ticket”)	Commonly known as ‘decriminalization’. Use and growing a small number of plants for personal use is a civil offence ordinarily resulting in a fine.
Cannabis social clubs and home grow	Home growing of small number of plants for personal use and social sharing is legal (no sales). Individual plant provisions can be combined for members of a social club.
Government monopoly and home grow	Cannabis is sold from government owned shops. There are age limits, no advertising and promotion, high excise taxes, restrictions on potency, plain packaging, mandated health warnings and limited number of outlets. A set number of plants are permitted to be grown at home for personal use.
Not-for-profit trusts with home grow	Community elected trusts sell cannabis and are required to spend a proportion of the revenue on community services, such as sport and arts. There are age limits, restricted advertising and promotion, high excise taxes, packaging restrictions, mandated health warnings and limits on number of outlets. A set number of plants are permitted to be grown at home for personal use.
Strict market regulation (“like tobacco”) and home grow	Cannabis is commercially sold with a high excise tax, age restrictions, no advertising or promotion, plain packaging, some restrictions on potency, mandated health warnings, and sales from licensed sellers only. A set number of plants are permitted to be grown at home for personal use.
Light market regulation (“like alcohol”) and home grow	There is largely a commercial cannabis market with limited restrictions on advertising and promotion, a small excise tax, age restrictions and some licensing and product labelling requirements. A set number of plants are permitted to be grown at home for personal use.
Unrestricted market (“like soft drinks”) and home grow	There is a commercial market for cannabis with only generic consumer goods regulation around product safety and retail selling. There is no excise tax, restrictions on advertising and promotion, restrictions on potency, limited labelling requirements, and no limits on number of outlets. A set number of plants are permitted to be grown at home.

(see Table 1). All reform options presented included the “home cultivation of cannabis” as the New Zealand Government considered this a core aspect of all reform options (Office of the Ministry of Justice, 2019). It is important to note that the New Zealand cannabis referendum debate was specifically concerned with the legal status of cannabis use and supply, not wider policy responses and settings in relation to cannabis harm, such as level of spending on treatment and prevention, although these factors are naturally part of the discussion of different reform approaches as reflected in our MCDA criteria.

Specifying the decision-making criteria and outcome levels

The two cannabis policy researchers based in New Zealand (CW and MR) initially identified the five key cannabis policy reform decision making criteria (i.e., health and social harm, illegal market size, reducing arrests, earning tax income, expanding treatment services) and related levels, by drawing on New Zealand Government documents discussing the overarching policy objectives of cannabis reform (Office of the Ministry of Justice, 2019; Parliamentary Counsel, 2020), previous New Zealand reports estimating cannabis harms and assessing law reform options, available New Zealand statistics on cannabis use and harm, and the policy evaluation literature from overseas cannabis reforms (McFadden Consultancy, 2016; New Zealand Institute of Economic Research (NZIER), 2020; Sense Partners, 2018).

Criteria 1 - Health and social harm

The baseline figure of the “health and social harm” of cannabis use in New Zealand used in the MCDA model of \$1.3 billion per year (NZD) was taken from the 2016 New Zealand Drug Harm Index (NZ-DHI) commissioned by the New Zealand Ministry of Health (McFadden Consultancy, 2016). The NZ-DHI provides a comprehensive evaluation of the costs of cannabis use in New Zealand, including the personal and community harm of use and related costs of interventions (e.g., hospitalizations, treatment & counselling, drug prevention). The NZ-DHI was written in collaboration with the New Zealand Ministry of Health and other government agencies who provided national statistics on drug use and harm for the report. The methodology was based on the earlier Australian Drug Harm Index methodology (originally commissioned in 2001 and then subsequently updated in 2003, 2006, and 2008). This methodology was adapted to New Zealand in 2008 and updated in 2016.

The NZ-DHI authors acknowledge a number of gaps and limitations of official statistics which require simplifying assumptions to complete the estimates, including difficulty assigning harms from poly-drug use to individual drug types (e.g., cannabis and methamphetamine co-use), quantifying the harm of drug dependency on families, and establishing the causal role of drug use in crime (McFadden Consultancy, 2016). A limitation specific to cannabis was New Zealand health statistics did not separate natural cannabis from synthetic cannabinoids, recording them together as a combined “cannabinoid” category (Mc-

Fadden [Consultancy, 2016](#)). Despite these issues, the NZ-DHI provides the official estimates of the social harm of drug use used in New Zealand.

Preliminary evaluations of the U.S. state “for profit” cannabis legalization reforms have raised concerns about declining prices, high-potency products, marketing and promotion practices, and industry influence over regulation development ([Caulkins & Kilmer, 2016](#); [Colorado Department of Health & Environment, 2021](#); [Davenport, 2019](#); [European Monitoring Centre for Drugs and Drug Addiction \(EMCDDA\), 2020](#); [Hall et al., 2019](#); [Hunt & Pacula, 2017](#); [Smart et al., 2017](#); [Subritzky et al., 2016](#); [2020](#), [Orens et al., 2018](#)) and some of these concerns have been reflected in subsequent post legalization findings from both Canada and the US ([Hammond et al., 2021](#), [Mahamad et al., 2020](#); [Rup et al., 2020](#)).

There is evidence from U.S. national data of increasing adult use, frequency of use and cannabis use disorder (CUD) in legal recreational cannabis states ([Cerdá et al., 2020](#)). It has subsequently been noted that only four US states (i.e., Colorado, Washington, Oregon, and Alaska) had established cannabis retail outlets during the period of this study (i.e., 2012 to 2016), and those had only been open for a relatively short period of time, suggesting that the longer-term impact of commercial legalization and higher potency legal products on harm is yet to be fully experienced ([EMCDDA, 2020](#)). Evaluations of the impact of cannabis legalization on youth in the early U.S. recreational legalization states (i.e. Colorado, Oregon, Washington State) who implemented largely commercial regimes have found mixed results with meta-analyses suggesting small increases in use ([Melchior et al., 2019](#), [Smart & Pacula, 2019](#), [Dilley et al., 2019](#)). The longer timeframe of cannabis legalization in Uruguay has allowed more evaluation, utilizing neighboring countries as control groups, and has found only minimal impacts on adolescent use and perceived risk of use to date ([Castillo-Carniglia et al., 2020](#); [Laqueur et al., 2020](#); [Schleimer et al., 2019](#)).

Drawing on the extensive research literature of effective public health regulation of alcohol and tobacco markets (e.g. [Gartner & Hall, 2020](#); [Pacula et al., 2014](#); [Stockwell et al., 2020](#) [Subritzky & Lenton, 2016](#)), we assumed that more restrictive regulatory approaches, such as government monopoly, non-commercial supply and strict market regulation, are likely to be more effective at reducing the health and social harms of legal cannabis use than lightly regulated commercial markets. Proponents of cannabis legalization have argued that a legal cannabis market could reduce the overall harm of cannabis, even if the total number of users increase, by improving the safety of legal cannabis products (e.g., via manufacture and potency controls) and by reducing barriers related to help seeking for dependent users. This may well be the case, but at the time of writing this article, we do not yet have the data, either from overseas jurisdictions or New Zealand, to support this argument.

Criteria 2 – Reduce arrests

All of the legalization options in our MCDA model projected large reductions in cannabis arrests following legalization regardless of the strictness of the regulatory framework. This is based on the understanding that following legalization cannabis related arrests would be limited to underage use, illegal supply, public disorder, and drug driving. This assumption is supported by evidence from U.S. states that have legalized cannabis where substantial reductions in arrest rates for cannabis have been achieved (e.g., arrest rates in Alaska, Washington, D.C., and Oregon have fallen by 90%) ([Adinoff and Reiman 2019](#)). Drawing on official New Zealand Police apprehension statistics, we used a baseline figure of 10,500 arrests per year for cannabis under prohibition in New Zealand ([Statistics NZ, 2016](#)). Note, this number includes all situations where police have contact with cannabis offenders regardless of whether this results in a formal arrest, prosecution, or conviction (i.e., some receive informal warnings, pre-charge warnings or diversion) ([Wilkins & Sweetsur, 2012](#)).

Criteria 3 – Reduce the size of the illegal market

All the legalization options in our MCDA projected significant reductions in the illegal cannabis market, while not entirely eliminating the illegal trade. Again, this reflects experience from legal cannabis jurisdictions in the U.S. and Canada where the illegal cannabis trade has been much reduced, but nonetheless has persisted [e.g., two years after legalization, 37% of Canadian users reported having purchased cannabis from an illegal source ([Government of Canada, 2021](#))]. The NZ-DHI estimated the annual revenue of the illegal market for cannabis to be \$548M based on aggregate cannabis consumption ([McFadden Consultancy, 2016](#)).

Criteria 4 – Earn tax revenue

The tax earnings figures in our MCDA assumed that the more heavily regulated legal market options (e.g., “government monopoly”, “not-for-profit” and “restricted markets”) are likely to impose higher excise rates and other taxes and hence collect more total tax revenue. Estimates of the magnitude of the economic benefits of a legal cannabis sector in New Zealand have varied. For example, an economic consultancy firm estimated the government revenues from cannabis legalization in New Zealand would be \$191-\$249M (NZ\$) ([Sense Partners, 2018](#)). The New Zealand Institute of Economic Research (NZIER), projected annual tax revenues from legal cannabis sales in New Zealand of \$490M (New Zealand Institute of Economic Research (NZIER) 2020). Most recently, the economic consultants BERL has advised the New Zealand Ministry of Justice that a legal cannabis sector in New Zealand would generate \$923M annually in taxation and licensing fees ([BERL, 2019](#)). Our projections are based on the actual tax earnings reported from legal cannabis sales in Colorado (i.e. \$200-300M), which has a comparable population to New Zealand ([Colorado Department of Health & Environment, 2021](#)). It is also important to note these are estimates of gross tax income and public expenditure is required to implement, regulate and enforce legal cannabis markets (e.g., the Colorado Marijuana Enforcement Division’s annual budget in 2020-21 is \$25M USD).

Criteria 5 – Expanding drug treatment

The most restrictive legalization options (e.g., “government monopoly”, “not-for-profit” and heavily regulated markets) were projected to invest more in drug treatment capacity as they would collect more cannabis excise tax, although ultimately these remain discretionary policy decisions. The estimate of current unmet demand for cannabis treatment in New Zealand came from the New Zealand National Committee for Addiction Treatment (NCAT) who calculated that only 50% of the people who want help for substance abuse are currently receiving it due to service capacity limits ([Sense Partners, 2018](#)). The New Zealand Drug Foundation has called for the doubling of the treatment budget to meet this unmet demand paid for by taxes from cannabis legalization ([Sense Partners, 2018](#)).

Review of criteria and levels by international cannabis policy experts

Five international cannabis policy experts (Tom Decorte, Benedikt Fischer, Beau Kilmer, Simon Lenton, Rosario Queirolo) with expertise and experience of the implementation of cannabis reforms in their own countries, were invited to review the MCDA model, firstly individually in advance of the MCDA workshop, and then collaboratively as a group during a face-to-face meeting one day before the workshop. This involved reviewing the policy decision making criteria and the projected outcomes assigned to each policy reform option. The final model comprised of the eight cannabis policy reform options, and five decision making criteria and projected outcome levels discussed above ([Table 2](#)).

Table 2
Cannabis policy reform options and projected outcomes.

POLICY OPTIONS	Health and social harm	Reduce arrests	Reduce size of illegal market	Earn tax revenue	Expand drug treatment services
Prohibition with criminal penalties (current approach)	No change, \$1.3b harm	No change, 10,500 arrested	No change, \$500m illegal market	None	No change, 50% of people who want treatment receive it
Prohibition with fines and home grow	No change, \$1.3b harm	Small reduction in arrests, e.g. down to 9,000	Small reduction, e.g. \$450m illegal market	None	Small increase, 60% of people who want treatment receive it
Cannabis social clubs and home grow	No change, \$1.3b harm	Small reduction in arrests, e.g. down to 9,000	Small reduction, e.g. \$450m illegal market	None	Small increase, 60% of people who want treatment receive it
Government monopoly and home grow	Small decrease, e.g. \$1.2b harm	Medium reduction, e.g. down to 5,000 arrests	Medium reduction, e.g. \$250m illegal market	Very large revenue, e.g. \$350m	Very large increase, 100% of people who want treatment receive it
Not-for-profit trusts and home grow	No change, \$1.3b harm	Medium reduction, e.g. down to 5,000 arrests	Medium reduction, e.g. \$250m illegal market	Large revenue, e.g. \$250m	Large increase, 85% of people who want treatment receive it
Strict market regulation and home grow	Small increase, e.g. \$1.4b harm	Medium reduction, e.g. down to 5,000 arrests	Medium reduction, e.g. \$250m illegal market	Large revenue, e.g. \$250m	Large increase, 85% of people who want treatment receive it
Light market regulation and home grow	Medium increase, e.g. \$1.6b harm	Large reduction, e.g. down to 3,000 arrests	Large reduction, e.g. \$200m illegal market	Medium revenue, e.g. \$200m	Medium increase, 75% of people who want treatment receive it
Unrestricted market and home grow	Large increase, e.g. \$1.8b harm	Very large reduction, e.g. down to 1,500	Very large reduction, \$100m illegal market	Medium revenue, e.g. \$200m	Small increase, 60% of people who want treatment receive it

Determining the weights for the different decision-making criteria and related levels

The PAPRIKA MCDA method

The MCDA model was developed using the 1000minds™ MCDA software platform (www.1000minds.com) which utilizes the PAPRIKA (Potentially All Pairwise RanKings of all possible Alternatives) method (for technical details, see [Hansen & Ombler, 2008](#)). Briefly, the PAPRIKA method asks decision makers to express their preferences for decision making criteria and projected outcome levels by ranking undominated outcomes defined on just two criteria at-a-time (and assuming all other criteria's categories are pairwise identical) (see [Fig. 1](#)). The trade-off questions are repeated with different pairs of criteria and outcome scenarios. Each time the decision-maker answers a trade-off question, all other scenario pairs that can be pairwise ranked by applying the logical property of 'transitivity' are identified and eliminated ([Wesselbaum, 2022](#)). Simulations have shown that if the decision-maker explicitly ranks undominated pairs defined on just two criteria at-a-time, the overall ranking of alternatives produced by the value model is very highly correlated with the true ranking of all possible trade-offs ([Hansen & Ombler, 2008](#)).

MCDA workshop

Forty-five key national stakeholders from government agencies, health, NGO, law enforcement, academia, pro-legalization activism, and industry attended the MCDA workshop on 16th October 2019 ([Table A.1](#)). These participants represented all the NZ government agencies involved in the cannabis reform debate (i.e., Ministries of Justice, Health, Social Development, Police, Health Promotion Agency, Customs and National Drug Intelligence Bureau), a number of health providers and professional societies (e.g., District Health Boards, Mental Health Foundation, New Zealand Nurses Organization, Mental health, addiction and disability workforce development), NGO's concerned with drug policy (e.g., NZ Drug Foundation, Public Health Association of New Zealand), cannabis industry (i.e., Hikurangi Enterprises Ltd, New Zealand Medicinal Cannabis Council), cannabis activism (i.e., NORML NZ) and academics from the addictions, medicine, public health and criminology fields. A leading anti-legalization advocacy group was also invited to the workshop but declined to attend. The workshop included representatives from the Ministry of Justice and Ministry of Health team (3 peo-

ple) tasked with developing the referendum proposal, but they recused themselves from voting due to conflict of interest (leaving a voting group of 42). The meeting was facilitated by the 1000minds™ software developers.

In the morning of the MCDA workshop, the five invited international cannabis policy researchers each made seminar presentations on the cannabis reform options implemented in their countries (i.e., Simon Lenton – Australian state decriminalization; Tom Decorte – Spain and Belgium social clubs; Rosario Queirolo – Uruguayan state-controlled market; Benedikt Fischer – Canadian strictly regulated market; Beau Kilmer – U.S. lightly regulated legal market). Marta Rychert presented on the "not-for-profit" trust model for cannabis based on working examples of alcohol licensing trusts and gaming machine gambling trusts in New Zealand ([Rychert & Wilkins, 2019](#)). The morning seminars introduced the workshop participants to the policy reform options that were part of the MCDA model, including summaries of known outcomes and outstanding gaps in data and understanding of consequences. The international presenters were encouraged to group the outcome data around the MCDA model criteria (i.e., "health and social harm", "number of arrests", "reducing the illegal market", "expanding drug treatment" and "earning tax"). Each seminar was followed by an extended Q&A session where participants were encouraged to ask further questions about the reform approach and related outcomes and unknowns.

The MCDA decision-making workshop was conducted in the afternoon and involved 42 participants who were invited to anonymously vote on each trade-off question using their mobile phone (i.e., Option A, Option B, and Option C "they are equal") (see [Fig. 1](#)). The results of each vote were displayed on a large screen at the front of the meeting room. If one of the three possible answers received more than 50% of the votes it was accepted as the final answer. If there was no such 'majority winner' after the vote, the participants discussed the question and voted again. If necessary, this process was repeated until a majority winner emerged. Each time the participants answered a question (after voting), the method adapted the selection of the next question based on their preceding answers (always one whose answer was not implied by earlier answers). A total of 27 trade-offs questions were answered by the stakeholder group during the MCDA workshop. Based on these answers, the PAPRIKA method calculated the final weights for the criteria and levels.

Table 3
Relative weighting of cannabis policy reform criteria (Highest to lowest ranking).

Criterion / levels	Preference value
Health and social harm	
Large increase, e.g. \$1.8b harm	0%
Medium increase, e.g. \$1.6b harm	17.5%
Small increase, e.g. \$1.4b harm	31.6%
No change, \$1.3b harm	40.5%
Small decrease, e.g. \$1.2b harm	45.9%
Reduce cannabis arrests	
No change, 10,500 arrested	0%
Small reduction in arrests, e.g. down to 9000	7.6%
Medium reduction, e.g. down to 5000 arrests	15.3%
Large reduction, e.g. down to 3000 arrests	23.0%
Very large reduction, e.g. down to 1500	30.6%
Reduction in size of illegal market	
No change, \$500m illegal market	0%
Small reduction, e.g. \$450m illegal market	5.1%
Medium reduction, e.g. \$250m illegal market	9.2%
Large reduction, e.g. \$200m illegal market	11.7%
Very large reduction, e.g. \$100m illegal market	13.3%
Expand drug treatment and prevention services	
No change, currently 50% of people treated	0%
Small increase, e.g. 60% of people treated	2.8%
Medium increase, e.g. 75% of people treated	5.1%
Large increase, e.g. 85% of people treated	6.8%
Very large increase, e.g. 100% of people treated	8.2%
Earn tax and community funding	
None	0%
Small revenue, e.g. \$150m	0.5%
Medium revenue, e.g. \$200m	1.0%
Large revenue, e.g. \$250m	1.5%
Very large revenue, e.g. \$350m	2.0%

Note: The bolded values represent the relative weights of the criteria overall (i.e., bolded values sum to 100%).

Ranking the policy reform options

From the participants' answers to the above trade-off questions, the 1000Minds software calculated the relative weights on the criteria and levels and from these ranked the policy options (for technical details, see Hansen & Ombler, 2008). The final ranking of the policy options was shown to the group, and this was followed by a group discussion of the rankings.

Results

Relative ranking of criteria

Table 3 presents the relative weights of the five criteria and the levels within each criterion. Controlling the "health and social harm" of cannabis use, and "reducing cannabis arrests" received the highest relative weightings from workshop participants. In contrast, earning "tax and community funding" from cannabis sales received the lowest weighting. Table 4 illustrates the relative importance of the different criteria and levels. For example, a small reduction in the "health and social harm" from cannabis use was judged to be over 20 times more important than a very large revenue from cannabis sales. A small reduction in the "health and social harm" from cannabis use was also considered to be over three times more important than a very large reduction in the illegal market for cannabis. Expanding drug treatment for cannabis use was considered to be four times more important than a very large revenue from cannabis sales.

Ranking of policy options

Table 5 presents the ranked cannabis policy options with their respective performances on the five decision-making criteria. "Government monopoly" received the highest total score (81%), followed by "not-for-profit trusts" (73%) and "strict market regulation" (65%). "Government monopoly" scored higher than the second ranked option of

"not-for-profit" trust almost entirely due to its projected better performance on the highly weighted "health and social harm" criteria (i.e., small decrease vs. no change) (45.9% vs. 40.5%), and slightly better performance on "drug treatment provision" (8.2% vs. 6.8%) and "tax revenue" (2.0% vs. 1.5%). The "strict market" option scored lower entirely because it scored relatively lower on controlling the "health and social harm" of cannabis use (31.6%) compared to the "government monopoly" and "not-for-profit" options. The "lightly regulated market" option scored lower due to its relatively poor performance on controlling the "health and social harm" of cannabis use (17.5%), while performing better on reducing arrests (23.0%) and the illegal market (11.7%). Prohibition with civil fines (i.e., commonly known as decriminalization) scored relatively well on controlling the "health and social harm" of cannabis use (31.6%), but had relatively low scores on reducing arrests (7.6%) and the illegal market (5.1%). It also provided no tax revenue (0.0%) and related improvement of drug treatment services (2.8%). Cannabis social clubs scored exactly the same as prohibition with civil fines (i.e., performing relatively well at controlling "health and social harms", but having limited impact on reducing arrests and the illegal market and offering little improvement in treatment capacity). The unrestricted market option (i.e., regulated like soda drinks), scored highest at reducing arrests (30.6%) and the illegal market (13.3%), as it involves only generic consumer goods regulation and hence involved very few regulations that could result in users' arrest or opportunities where illegal supply could out compete legal sales, but achieved the lowest with respect to controlling "health and social harm" of cannabis use (0.0%). "Prohibition with criminal penalties" received the lowest ranking as, although it scored relatively well at controlling the health and social harm (40.5%), largely due to containing cannabis use, it resulted in no change in the number of cannabis arrests (0.0%), drug treatment capacity (0.0%), or the size of the illegal market (0.0%).

Discussion

The New Zealand national stakeholders ranked the strictly regulated legal cannabis market reform options (i.e., "government monopoly", "not-for-profit", "strict market like tobacco") higher than the prohibition-based options ("prohibition", "decriminalization") as the former were projected to substantially reducing cannabis arrests and the size of the illegal market, and also contribute to more funding for drug treatment, while minimizing any increase in the health and social harm of cannabis use. The strictly regulated legal cannabis market reform options were also ranked higher than the more commercial legal market options ("lightly regulated", "unrestricted" market) largely because they were projected to provide greater control of the social and health harms of cannabis use, while also offering substantial reductions in cannabis arrests and the illegal market. Rogeberg et al. (2018) employed an MCDA process with experts to evaluate policy options for cannabis and also found state control (of production and sale) to be the preferred reform option, and conversely prohibition to be the lowest ranked option. While Rogeberg et al.'s (2018) decision making criteria were not directly comparable with ours (and used a different MCDA software package - Catalyze Hiview 3®), controlling health, social and public impacts were influential in favoring state control over the free market option.

The stakeholders also considered reducing arrests for cannabis a relatively high priority outcome of reform. This may reflect long standing concern in New Zealand about the higher conviction and imprisonment rates for Māori (the indigenous people of Aotearoa/New Zealand) compared to other ethnicities, and the fact that Māori are three times more likely to be arrested and convicted for cannabis offences than non-Māori (Fergusson et al., 2003; Office of the Ministry of Justice, 2019). There may also be a wider moral view that a criminal conviction is a disproportionately severe penalty for minor cannabis offending. Rogeberg et al.'s (2018) MCDA also found experts placed a high relative value on reducing the criminalization of cannabis users and the illegal market as important criterion in evaluating reform op-

Table 4
Relative importance of cannabis policy reform criteria.

	Health and social harm	Reducing arrests	Reduction in illegal market	Expand drug treatment	Earn tax revenue
Health and social harm	-	1.5	3.5	5.6	22.5
Reducing arrests	0.7	-	2.3	3.8	15.0
Reduction in illegal market	0.3	0.4	-	1.6	6.5
Expand drug treatment	0.2	0.3	0.6	-	4.0
Earn tax revenue	0.0	0.1	0.2	0.2	-

Table 5
Ranked cannabis policy reform options.

Policy option	Rank	Score	Health	Arrest	Illegal mkt	Treatment	Tax
Government monopoly and home grow	1 st	80.6%	45.9%	15.3%	9.2%	8.2%	2.0%
Not-for-profit trusts and home grow	2 nd	73.4%	40.5%	15.3%	9.2%	6.8%	1.5%
Strict market regulation (like tobacco) and home grow	3 rd	64.5%	31.6%	15.3%	9.2%	6.8%	1.5%
Light market regulation (like alcohol) and home grow	4 th	58.3%	17.5%	23.0%	11.7%	5.1%	1.0%
Prohibition with fines (speeding ticket) and home grow	5 ^{th=}	56.0%	40.5%	7.6%	5.1%	2.8%	0.0%
Cannabis social clubs and home grow	5 ^{th=}	56.0%	40.5%	7.6%	5.1%	2.8%	0.0%
Unrestricted market (like soft drinks) and home grow	7 th	47.6%	0.0%	30.6%	13.3%	2.8%	1.0%
Prohibition with criminal penalties (current approach)	8 th	40.5%	40.5%	0.0%	0.0%	0.0%	0.0%

tions. Sheehan et al. (2021) examined racial differences in cannabis arrest rates among adults and youths after state-wide cannabis decriminalization, legalization and no policy change in the U.S. from 2000 to 2019, and found there was a substantial decrease in absolute cannabis arrests among Black adults as an immediate response to decriminalization, but the relative racial disparity remained, perhaps reflecting the greater difficulties of poorer individuals at paying civil fines. In U.S. states that enacted cannabis legalization, there was a clear reduction in arrests among both Black and White adults as well as a reduction in the racial disparity. However, as the reduction trend began before the implementation of cannabis legalization, this reduction was likely not solely attributable to legalization.

The stakeholders placed the lowest relative importance on “tax earnings” as a reform outcome, even when the tax revenue presented involved seemingly substantial sums (i.e., \$200-\$350M per year NZD). Cannabis industry and business lobby groups often emphasize the potential tax earnings and economic development opportunities of cannabis legalisation as compelling reasons for law reform, although estimates of these financial returns have varied considerable between New Zealand commentators (e.g., Sense Partners, 2018, NZIER, 2020, BERL, 2019) and they are rarely offset with a discussion of additional health and social service spending which may emerge from increased legal cannabis use and harm. Similarly, the experts in Rogeberg et al.’s (2018) MCDA placed a relative low value on earning state revenue and reducing public spending on law enforcement as a factor influencing the cannabis reform option.

The stakeholders also gave the reduction in the illegal market a relatively low weighting, even when substantial reductions in illegal market activity were being projected (i.e. \$100-\$250M or 50%-80% reduction of the illegal market). This is surprising as reducing the illegal market is often presented as a critical objective of cannabis legalization (Oregon Liquor Control Commission, 2019), and indeed, higher legal cannabis taxes, potency controls and retail restrictions are sometimes opposed on the basis these will handicap the legal cannabis sector from competing against the illegal trade (New Zealand Institute of Economic Research (NZIER) 2020). It may be the case that the low priority given to reducing the illegal market for cannabis by the New Zealand stakeholders reflects a belief that much of the illegal cannabis market in New Zealand is relatively innocuous, and indeed, may provide much needed seasonal income in some economically depressed rural regions (Walker et al., 1998). In contrast, the argument about reducing illegal market activity has been particularly relevant for other countries, such as Uruguay and Mexico, where cannabis legalization has been proposed as a means to reduce levels of violence and instability related to wider narco-trafficking (Queirolo et al., 2019).

Increasing drug treatment capacity also received a low relative importance by the stakeholders. This may reflect a perception that only a minority of cannabis users are ever likely to require drug treatment. This perception is largely supported by a recent systematic review that found overall 22% of cannabis users experienced CUD (range 10–30%), with 13% suffering the more serious cannabis dependence (largely under prohibition regimes) (Leung et al., 2020).

Limitations

We acknowledge a number of limitations with our MCDA. First, as underlined by the domestic and international cannabis policy experts at the MCDA workshop, considerable gaps remain in relation to understanding of full consequences of the different cannabis law reform options implemented overseas, particularly with regard to the recent legalization of recreational cannabis in select jurisdictions of the Americas. There is further uncertainty concerning how these overseas reforms might be translated and implemented in New Zealand with its distinct socio-cultural, political and economic ecology (Fischer et al., 2020a; Wilkins & Rychert, 2020b). The projected outcome levels of our MCDA model are designed to communicate broadly sketched plausible scenarios rather than precise estimates, and this limitation was clearly communicated to the stakeholders involved in the MCDA exercise both during the morning seminars and afternoon MCDA workshop. While New Zealand boasts several world renown longitudinal studies of city based birth cohorts that have tracked the lifetime impact of cannabis use, there are some significant gaps in national population level statistical data on cannabis use and harm (BERL, 2019). For example, the last population level data on frequency of cannabis use, dependency and related harms was collected in 2007/08 (BERL, 2019). The handful of existing attempts to model outcomes from cannabis law reform in New Zealand have faced significant domestic and international data limitations, most importantly the limited data on cannabis legalization implemented overseas (Sense Partners, 2018 as critiqued in Wilkins et al., 2019).

As described earlier, we utilized the NZ-DHI estimates of the health and social harm of cannabis as the starting point for our MCDA model. While this report had access to national statistics on cannabis use and harm, there remained gaps in data and, as a result, simplifying assumptions had to be made to complete the estimates (McFadden Consultancy, 2016). A number of these assumptions are controversial, such as the decision to split the remaining 64 drug related deaths that could not be assigned to opioid overdose (i.e., 10 deaths) or psychedelics (1 death) evenly between amphetamines and cannabinoids (i.e., 32 deaths each). This decision may be linked to the inability at the time to separate natural cannabis from synthetic cannabinoids in official statis-

tics, as synthetic cannabinoids have been linked to a number of overdoses in New Zealand (Wilkins & Rychert, 2018). Furthermore, all the acquisitive crime committed by people with cannabis dependence is assigned to cannabis harm without determining the causal role cannabis use may have played in motivating these offences.

Second, as noted at the beginning of this paper, one of the recommendations from the recent MCDA of drug policy is to broaden the decision-making group (Rogeberg et al., 2018; Rolles & Measham, 2011). Our MCDA achieved this objective to an extent by including officials from a range of government agencies and NGO workers concerned with drug and health issues, including Māori, cannabis legalization activists, medicinal cannabis industry, drug treatment and mental health, and law enforcement organizations. This could be taken further to include those most affected by the current cannabis prohibition and reform options, including youth, Māori, Pasifika, parents of adolescents, and those living in high deprivation communities. To ensure the views of these affected groups are not swamped by the majority view in a combined workshop, a series of MCDA workshops could be conducted with each entirely compromising members of one of the affected groups (e.g., a Māori MCDA workshop). While we were not able to convince the main anti-cannabis legalization activist group to attend the MCDA, we had a range of government and NGO stakeholder participants who may have been ambivalent, or even opposed, legalization (e.g., police, NGO from mental health, health practitioners, and drug treatment). The refusal of the main anti-legalization group to attend may reflect their view, wrongly held in this case, that the forum is not interested in their perspective or values. Indeed, the rejection of the NZ cannabis referendum has in part been explained by a failure to engage with conservative right-wing voters about how cannabis legalization may align with their political values (such as promoting personal freedom and responsibility, eliminating inefficient government spending, and reducing government power over citizens) (Rychert & Wilkins, 2021, Wilkins et al, 2022). Anti-legalization groups may well have supported the current prohibition approach *and* more investment in drug treatment and prevention. This option was not part of our MCDA policy options as we were primarily aiming to inform the debate around the cannabis referendum which was specifically concerned with the legal status of cannabis use and supply, not wider policy settings addressing cannabis harm under the current prohibition, such as increasing the level of funding of treatment and prevention.

Third, MCDA is an instrumental group decision making tool that focuses on tangible outcomes of policy decisions. It does not directly address or debate the moral basis of policy positions. Moral views of cannabis use were found to play an important part in how people voted in the NZ cannabis referendum (Wilkins et al, 2021) and likely influenced how stakeholders voted in the MCDA trade-offs. Yet, as outlined earlier in this paper, the purpose of MCDA is to facilitate group decision making concerning controversial policy issues by asking participants to consider tangible trade-offs in outcomes to reach pragmatic compromises. The closeness of the final NZ cannabis referendum result (48.4% for, vs. 50.7% against) illustrated both significant support for reform and concern about the specific reform proposal put forward for the referendum vote (i.e., the Cannabis Legalization and Control Bill or CLCB). The CLCB most closely resembled the “strict market like tobacco” option in our MCDA. Our MCDA results suggest a higher stakeholder support for two even more restrictive legal market options, “government monopoly” and “not-for-profit” trusts.

Conclusions

The MCDA of cannabis policy options completed by a range of New Zealand stakeholders underlined the high importance placed on controlling the health and social harm of cannabis use, while also reducing the number of cannabis arrests and the size of the illegal market. Strictly regulated legal market options were ranked highest as they were projected to minimize the health and social harms of cannabis use via strong

public health regulation, while also substantially reducing arrests and the size of the illegal market by legalizing the use and sale of cannabis.

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Ethics approval

The authors declare that they have obtained ethics approval from an appropriately constituted ethics committee/institutional review board where the research entailed animal or human participation.

Massey University Human Subjects Ethics Committee (Northern Committee) Low Risk assessment.

Declarations of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix

Table A.1.

Table A.1
Participating stakeholders/organizations at the MCDA workshop.

Stakeholder type	Organization
Government	Ministry of Health
	Ministry of Justice (observing)
	Ministry of Social Development
	Health Promotion Agency
Health	Capital and Coast District Health Board
	Middlemore Hospital
	Waitemata District Health Board
	Hāpai Te Hauora (Māori Public Health provider)
	Drug and Alcohol Practitioners' Association Aotearoa–New Zealand
	New Zealand Medical Cannabis Council
	New Zealand Nurses Organization
	Te Pou (Mental health, addiction and disability workforce development)
NGO	National Poisons Centre
	Community Action on Youth and Drugs
	New Zealand Drug Foundation
	Mental Health Foundation
	Public Health Association of New Zealand
	Ngai Te Rangi Iwi
Academia	Odyssey (drug treatment provider)
	National Addiction Centre (Otago University)
	Department of Psychological Medicine (Otago University)
	Design School (Massey University)
	School of Psychology (Massey University)
	Schools of Population Health & Pharmacy (Auckland University)
	Criminology Department (Auckland University)
	Criminology Department (Victoria University)

(continued on next page)

Table A.1 (continued)

Stakeholder type	Organization
	Department of Pharmacology and Toxicology (Otago University) Gambling and Addictions Research Centre (Auckland University of Technology) Christchurch health and Development Study (Otago University)
Law enforcement	New Zealand Police New Zealand Customs Service National Drug Intelligence Bureau Independent Police Conduct Authority of New Zealand
Activism	NORML NZ
Media	Media blogger
Industry	Hikurangi Enterprises Ltd (Medicinal cannabis company) NZ Medicinal Cannabis Council

References

- Barry, R. A., & Glantz, S. A. (2016). A public health framework for legalized retail marijuana based on the US experience: Avoiding a new tobacco industry. *PLoS Medicine*, 13(9), Article e1002131.
- Barry, R. A., & Glantz, S. A. (2018). Marijuana regulatory frameworks in four US states: An analysis against a public health standard. *American Journal of Public Health*, 108(7), 914–923.
- BERL. (2019). *Evidence to inform a regulated cannabis market* Wellington <https://berl.co.nz/sites/default/files/2020-09/Evidence-to-inform-a-regulated-cannabis-market-June-2020-PROACTIVE-FINAL.pdf>.
- Bonomo, Y., Norman, A., Biondo, S., Bruno, R., Daglish, M., Dawe, S., et al., (2019). The Australian drug harms ranking study. *Journal of Psychopharmacology*, 33, 759–768.
- Castillo-Carniglia, A., Rivera-Aguirre, A., Calvo, E., Queirolo, R., Keyes, K. M., & Cerdá, M. (2020). Trends in marijuana use in two Latin American countries: An age, period and cohort study. *Addiction*, 115, 2089–2097.
- Caulkins, J., & Kilmer, B. (2016). Considering marijuana legalization carefully: insights for other jurisdictions from analysis for Vermont. *Addiction*, 111, 2082–2089.
- Caulkins, J. P., Kilmer, B., Kleiman, M. A., MacCoun, R. J., Midgett, G., Ogleby, P., et al., (2015). *Considering marijuana legalization: insights for Vermont and other jurisdictions*. Santa Monica, CA: RAND Corporation.
- Cerda, M., & Kilmer, B. (2017). Uruguay's middle-ground approach to cannabis legalization. *International Journal of Drug Policy*, 42(1), 118–120.
- Cerda, M., Mauro, C., Hamilton, A., Levy, N. S., Santaella-Tenorio, J., Hasin, D., Wall, M. M., Keyes, K. M., & Martins, S. S. (2020). Association between recreational marijuana legalization in the United States and changes in marijuana use and cannabis use disorder from 2008 to 2016. *JAMA Psychiatry*, 77(2), 165–171. 10.1001/jamapsychiatry.2019.3254.
- Colorado Department of Health and Environment. (2021). *Monitoring health concerns related to marijuana - reports and summaries* Available at <https://marijuanahealthinfo.colorado.gov/reports-and-summaries> Accessed May 12, 2021.
- Davenport, S. (2019). Price and product variation in Washington's recreational cannabis market. *International Journal of Drug Policy* in press 12 September.
- Decorte, T., Lenton, S., & Wilkins, C. (2020a). Introduction. Decorte, T., Lenton S., Wilkins C. (Eds.). *Legalizing cannabis: Experiences, lessons and scenarios*. London: Routledge.
- Decorte, T., Lenton, S., & Wilkins, C. (2022b). *Legalizing cannabis: Experiences, lessons and scenarios*. London: Routledge.
- Decorte, T., Pardala, M., Queirolob, R., Boicid, M., Avilésd, C., & Franquerod, O. (2017). Regulating Cannabis social clubs: A comparative analysis of legal and self-regulatory practices in Spain, Belgium and Uruguay. *International Journal of Drug Policy*, 43, 44–56.
- Department for Communities and Local Government. (2009). *Multi-criteria analysis: A manual*. London: Communities and Local Government Publications Available at http://eprints.lse.ac.uk/12761/1/Multi-criteria_Analysis.pdf Accessed 2nd March 2021.
- Dilley, J.A., Richardson, S. M., Kilmer, b., Pacula, R. L., Segawa, M. B., & Cerdá, M. (2019). Prevalence of Cannabis use in youths after legalization in Washington State. *JAMA Pediatrics*, 173(2) February., Number.
- Eastwood, N., Fox, E., & Rosmarin, A. (2016). *A quiet revolution: drug decriminalization across the globe*. London: release Retrieved from <https://www.release.org.uk/sites/default/files/pdf/publications/A%20Quiet%20Revolution%20-%20Decriminalisation%20Across%20the%20Globe.pdf>.
- Eastwood, N. (2020). Decriminalization around the world. In *Legalizing cannabis: Experiences, lessons and scenarios* (pp. 133–153). London: Routledge.
- European Monitoring Centre for Drugs and Drug Addiction (EMCDDA). (2020). *Monitoring and evaluating changes in cannabis policies: Insights from the Americas*. Luxembourg, Publications Office of the European Union EMCDDA Technical Report.
- Fergusson, D., Swain-Campbell, N., & Horwood, J. (2003). Arrests and convictions for cannabis related offences in a New Zealand birth cohort. *Drug Alcohol Dependence*, 70, 53–63.
- Fischer, B., & Daldegan-Bueno, D. (2020). New Zealand's 'Cannabis Legalisation and Regulation Bill': An evidence-based assessment and critique of essential regulatory components towards policy outcomes. *The New Zealand Medical Journal*, 133, 103–111.
- Fischer, B., Daldegan-Bueno, D., & Boden, J. M. (2020a). Facing the option for the legalisation of cannabis use and supply in New Zealand: An overview of relevant evidence, concepts and considerations. *Drug Alcohol Review*, 39, 555–567.
- Fischer, B., Lee, A., O'Keefe-Markman, C., & Hall, W. (2020b). Initial indicators of the public health impacts of recreational cannabis legalization in Canada. *EClinicalMedicine*, 20. 10.1016/j.eclim.2020.100294.
- Gartner, C., & Hall, W. (2020). Lessons from tobacco regulation for cannabis product regulation. Decorte, T., Lenton S., Wilkins C. (Eds.). *Legalizing Cannabis: Experiences, lessons and scenarios*. London: Routledge.
- Government of Canada. (2021). *Canadian Cannabis Survey 2021: Summary* <https://www.canada.ca/en/health-canada/services/drugs-medication/cannabis/research-data/canadian-cannabis-survey-2021-summary.html#a3> Accessed Feb 18 2022.
- Hall, W., Stjepanović, D., Caulkins, J., Lynskey, M., Leung, J., Campbell, G., et al., (2019). Public health implications of legalising the production and sale of cannabis for medicinal and recreational use. *Lancet*, 394, 1580–1590.
- Hammond, D., Wadsworth, E., Reid, J. L., & Burkhalter, R. (2021). Prevalence and modes of cannabis use among youth in Canada, England, and the US, 2017 to 2019. *Drug and Alcohol Dependence*, 219. 10.1016/j.drugalcdep.2020.108505.
- Hansen, P., & Ombler, F. (2008). A new method for scoring additive multi-attribute value models using pairwise rankings of alternatives. *Journal of Multi-Criteria Decision Analysis*, 15, 87–107.
- Heatherington, J. (2020a). *Petition of Jacob Heatherington: Decriminalise the recreational use of cannabis* November. Available at https://www.parliament.nz/en/pb/petitions/document/PET_102561/petition-of-jacob-heatherington-decriminalise-the-recreational Accessed May 12 2021.
- Heatherington, J. (2020b). *Petition request: Decriminalise the recreational use of cannabis* November 2020 Available at https://www.parliament.nz/en/pb/petitions/document/PET_102561/petition-of-jacob-heatherington-decriminalise-the-recreational Accessed.
- Hughes, D., Waddingham, E., Mt-Isa, S., Goginsky, A., Chan, E., Downey, G. F., et al., (2016). Recommendations for benefit-risk assessment methodologies and visual representations. *Pharmacoepidemiology and Drug Safety*, 25, 251–262.
- Hunt, P., & Pacula, R. (2017). Early impacts of marijuana legalization: An evaluation of prices in Colorado and Washington. *The Journal of Primary Prevention*, 38, 221–248.
- Laqueur, H., Rivera-Aguirre, A., Shev, A., Castillo-Carniglia, A., Rudolph, K. E., Ramirez, J., et al., (2020). The impact of cannabis legalization in Uruguay on adolescent cannabis use. *The International Journal of Drug Policy*, 80, Article 102748.
- Leung, J., Chan, G. C. K., Hides, L., & Hall, W. D. (2020). What is the prevalence and risk of cannabis use disorders among people who use cannabis? a systematic review and meta-analysis. *Addictive Behaviors*, 109, Article 106479.
- Leung, J., Chiu, C. Y. V., Stjepanović, D., & Hall, W. (2018). Has the legalisation of medical and recreational cannabis use in the USA affected the prevalence of cannabis use and Cannabis use disorders? *Current Addiction Reports*, 5, 403–417.
- Leung, J., Chiu, V., Chan, G. C. K., Stjepanović, D., & Hall, W. D. (2019). What have been the public health impacts of Cannabis legalisation in the USA? A review of evidence on adverse and beneficial effects. *Current Addiction Reports*, 6, 418–428.
- Consultancy, McFadden (2016). *Research report: The New Zealand drug harm index 2016*. Wellington: Ministry of Health <http://www.health.govt.nz/system/files/documents/publications/nz-drug-harm-index-2016-2nd-ed-jul16.pdf>.
- Mahamad, S., Wadsworth, E., Rynard, V., Goodman, S., & Hammond, D. (2020). Availability, retail price and potency of legal and illegal cannabis in Canada after recreational cannabis legalisation. *Drug and Alcohol Review*, 39(4), 337–346. 10.1111/dar.13069.
- Melchior, M., Nakamura, A., Bolze, C, et al., (2019). Does liberalisation of cannabis policy influence levels of use in adolescents and young adults? A systematic review and meta-analysis. *BMJ Open*, 9, Article e025880. 10.1136/bmjopen-2018-025880.
- Morton, A., Airoldi, M., & Phillips, L. D. (2009). Nuclear risk management on stage: A decision analysis perspective on the UK's committee on radioactive waste management. *Risk Analysis*, 29, 764–779.
- New Zealand Institute of Economic Research (NZIER). (2020). *NZ's cannabis referendum 2020: Some facts and recommendations about the process of cannabis legalisation*. NZIER public discussion paper - Working paper 2020/01 Wellington, New Zealand.
- Nutt, D., King, L., & Phillips, L. on behalf of the Independent Scientific Committee on Drugs. (2010). *Drug harms in the UK: A multicriteria decision analysis*. Lancet Published online November 1, 2010. 10.1016/S0140-6736(10)61462-6.
- Herald, NZ (2017). *Kiwis to vote on changing cannabis laws* 20 October. Available at https://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=11935061 Accessed 11 March 2020.
- Office of the Ministry of Justice. (2019). *2020 Cannabis Referendum - legislative process and overarching policy settings for the regulatory model [Cabinet Paper]* 6 May Available at <https://www.beehive.govt.nz/sites/default/files/2019-05/Proactive%20Release%20-%20Cabinet%20paper%20-%202020%20Cannabis%20Referendum%20-%207%20May%202019.pdf> Accessed 11 March 2020.
- Oregon Liquor Control Commission. (2019). *2019 recreational marijuana supply and demand legislative report* Portland Oregon [https://www.oregon.gov/olcc/marijuana/Documents/Bulletins/2019%20Supply%20and%20Demand%20Legislative%20Report%20FINAL%20for%20Publication\(PDFA\).pdf](https://www.oregon.gov/olcc/marijuana/Documents/Bulletins/2019%20Supply%20and%20Demand%20Legislative%20Report%20FINAL%20for%20Publication(PDFA).pdf).
- Orens, A., Light, M., Lewandowski, B., Rowberry, J., & Saloga, C. (2018). *Market size and demand for marijuana in Colorado 2017 Market Update*. MPG Marijuana Policy Group <https://www.colorado.gov/pacific/sites/default/files/MED%20Demand%20and%20Market%20Study%2020082018.pdf>.
- Pacula, R., Kilmer, B., Wagenaar, A., Chaloupka, F., & Caulkins, J. (2014). Developing public health regulations for marijuana: Lessons from alcohol and tobacco. *The American Journal of Public Health*, 104, 1021–1028.

- Parliamentary Counsel. (2020). Cannabis legalisation and control bill - exposure draft for referendum. *Explanatory Note*. Available at <https://www.referendums.govt.nz/materials/Cabinet-paper-Summary-of-policies-Cabinet-minutes-Exposure-draft-Cannabis-Legalisation-and-Control-Bill.pdf>. Accessed 19 May 2020.
- Queirolo, R. (2020). Uruguay: the first country to legalize cannabis. In *Legalizing Cannabis: Experiences, lessons and scenarios* (pp. 116–130). London: Routledge.
- Queirolo, R., Boidi, M. F., & Cruz, J. M. (2016). Cannabis clubs in Uruguay: The challenges of regulation. *The International Journal of Drug Policy*, 34, 41–48.
- Queirolo, R., Rossel, C., Álvarez, E., & Repetto, L. (2019). Why Uruguay legalized marijuana? The open window of public insecurity. *Addiction*, 114, 1313–1321.
- Rogeberg, O. (2018). Prohibition, regulation or laissez faire: The policy trade-offs of cannabis policy. *The International Journal of Drug Policy*, 56, 153–161 2018.
- Rogeberg, O., Bergsvik, D., Phillips, L. D., van Amsterdam, J., Eastwood, N., Henderson, G., et al., (2018). A new approach to formulating and appraising drug policy: A multi-criterion decision analysis applied to alcohol and cannabis regulation. *The International Journal of Drug Policy*, 56, 144–152.
- Rolles, S., & Measham, F. (2011). Questioning the method and utility of ranking drug harms in drug policy. *The International Journal of Drug Policy*, 22, 243–246.
- Rup, J., Goodman, S., & Hammond, D. (2020). Cannabis advertising, promotion and branding: Differences in consumer exposure between 'legal' and 'illegal' markets in Canada and the US. *Preventive Medicine*, 133. 10.1016/j.ypmed.2020.106013.
- Rychert, M., & Wilkins, C. (2019). A 'community enterprise' model for recreational cannabis: Lessons from alcohol licensing trusts in New Zealand. *The International Journal of Drug Policy*, 67, 72–78.
- Rychert, M., & Wilkins, C. (2021). Why did New Zealand's referendum to legalise recreational cannabis fail? *Drug and Alcohol Review* published online 7 March. 10.1111/dar.13254.
- Schleimer, J. P., Rivera-Aguirre, A. E., Castillo-Carniglia, A., Laqueur, H. S., Rudolph, K. E., Suárez, H., et al., (2019). Investigating how perceived risk and availability of marijuana relate to marijuana use among adolescents in Argentina, Chile, and Uruguay over time. *Drug and Alcohol Dependence*, 201, 115–126.
- Sense Partners. (2018). *Estimating the impact of drug policy options*. Wellington, New Zealand Drug Foundation <https://www.drugfoundation.org.nz/assets/uploads/Cost-benefit-analysis-drug-law-reform.pdf>.
- Sheehan, B. E., Gruzca, R. A., & Plunk, A. D (2021). Association of racial disparity of cannabis possession arrests among adults and youths with statewide cannabis decriminalization and legalization. *JAMA Health Forum*, 2(10), Article e213435. 10.1001/jamahealthforum.2021.3435.
- Smart, R., Caulkins, J., Kilmer, B., Davenport, S., & Midgett, G. (2017). Variation in cannabis potency and prices in a newly legal market: Evidence from 30 million cannabis sales in Washington state. *Addiction*, 112, 2167–2177.
- Smart, R., & Pacula, R. (2019). Early evidence of the impact of cannabis legalization on cannabis use, cannabis use disorder, and the use of other substances: Findings from state policy evaluations. *American Journal of Drug and Alcohol Abuse*, 45, 644–663.
- Statistics, NZ (2016). *New Zealand Police apprehensions for cannabis offences* p. 2022 Table builder available at.
- Stockwell, T., Giesbrecht, N., Sher, A., Thomas, G., Vallance, K., & Wettlaufer, A. (2020). Lessons learned from the alcohol regulation perspective. Decorte, T., Lenton S., Wilkins C. (Eds.). *Legalizing Cannabis: Experiences, lessons and scenarios*. London: Routledge.
- Subritzky, T., Lenton, S., & Pettigrew, S. (2016). Legal cannabis industry adopting strategies of the tobacco industry. *Drug and Alcohol Review*, 35, 511–513.
- Subritzky, T., Lenton, S., & Pettigrew, S. (2020). Practical lessons learned from the first years of the regulated recreational cannabis market in Colorado. In *Legalizing Cannabis: Experiences, lessons and scenarios* (pp. 39–61). London: Routledge.
- van Amsterdam, J., Nutt, D., Phillips, L., & van den Brink, W. (2015). European rating of drug harms. *The Journal of Psychopharmacology*, 29, 655–660.
- Walker, L., Cocklin, C., & Blunden, G. (1998). *Cannabis highs and lows: Sustaining and dislocating rural communities in Northland*. Auckland, New Zealand: University of Auckland Department of Geography.
- Wesselbaum, D., & Hansen, P. (2022). Lockdown design: which features of lockdowns are most important to COVID-19 experts? *Journal of the Royal Society of New Zealand*. 10.1080/03036758.2022.2048675.
- Wilkins, C. (2018). A "not-for-profit" regulatory model for legal recreational cannabis: Insights from the regulation of gaming machine gambling in New Zealand. *The International Journal of Drug Policy*, 53, 115–122.
- Wilkins, C., & Rychert, M. (2018). Responding to a new wave of high potency synthetic cannabinoids [Editorial]. *New Zealand Medical Journal*, 131(1481), 6–8 A44.
- Wilkins, C., & Rychert, M. (2020a). Assessing New Zealand's Cannabis legalisation and control bill: Prospects and challenges. *Addiction* published online July 4. 10.1111/add.15144.
- Wilkins, C., & Rychert, M. (2020b). The Government's proposal to legalise cannabis in New Zealand: 10 key questions [Editorial]. *New Zealand Medical Journal*, 133, 9–15.
- Wilkins, C., Rychert, M., Romeo, J., & Randerson, S. (2019). Smoke in our eyes: The Sense Partners' evaluation of the legalisation of cannabis in New Zealand [Editorial]. *New Zealand Medical Journal*, 132, 6–9. <https://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2019/vol-132-no-1490-22-february-2019/7811>.
- Wilkins, C., Tremewan, J., Rychert, M., Atkinson, Q., Fischer, G., & Lavender Forsyth, A. (2021). Predictors of voter support for the legalization of recreational cannabis use and supply via a national referendum. *International Journal of Drug Policy* Open Access, published online September. 10.1016/j.drugpo.2021.103442.
- Wilkins, C., & Sweetsur, P. (2012). Criminal justice outcomes for cannabis use offences in New Zealand, 1991–2008. *International Journal of Drug Policy*, 23, 505–511.
- Wilson, S. (2020). *Another cannabis referendum? Vote proposed on decriminalisation November 28* Available at <https://www.nzherald.co.nz/nz/another-cannabis-referendum-vote-proposed-on-decriminalisation/Q6YZC5DRLAUMRE2PVMAPERH5BQ/> Accessed May 12 2021.