Examining the blurred boundaries between medical and recreational cannabis – Results from an international study of small-scale cannabis cultivation

Pekka Hakkarainen[1],Tom Decorte[2], Sharon Sznitman[3], Karoliina Karjalainen[1], Monica J. Barratt[4,5,6], Vibeke Frank[7], Simon Lenton[5], Gary Potter[8], Bernd Werse[9] & Chris Wilkins[10]

[1] National Institute for Health and Welfare (THL), Alcohol, Drugs and Addictions Unit, P.O. Box 30, FI-00271, Helsinki, Finland, pekka.hakkarainen@thl.fi, karoliina.karjalainen@thl.fi

[2] Institute for Social Drug research (ISD), Faculty of Law, Ghent University, Universiteitsstraat 4, B-9000 Gent, Belgium, Tom.decorte@ugent.be

[3] School of Public Health, University of Haifa, Eshkol Tower, room 705, Mt. Carmel, 3190501 Haifa, Israel, sznitman@research.haifa.ac.il

[4.] Drug Policy Modelling Program, National Drug and Alcohol Research Centre, UNSW, 22-32 King St, Randwick NSW 2031, Australia, m.barratt@unsw.edu.au

[5.] National Drug Research Institute, Faculty of Health Sciences, Curtin University, PO Box U6187, Perth WA 6845, Australia, S.Lenton@curtin.edu.au

[6.] Behaviours and Health Risks Program, Burnet Institute, 85 Commercial Rd, Melbourne VIC 3004, Australia

[7.] Centre for Alcohol and Drug Research, Aarhus University, Bartholins Allé 10, Build. 1322, 3., 8000 Aarhus C, Denmark, vaf.crf@psy.au.dk

[8] Lancaster University Law School, Bowland North, Bailrigg, Lancaster, LA1 4YN, United Kingdom, g.potter2@lancaster.ac.uk

[9] Goethe-Universität, Institut für Sozialpädagogik und Erwachsenenbildung, Centre for Drug Research, Theodor-W.-Adorno-Platz 6, D-60629 Frankfurt am Main, Germany, werse@em.uni-frankfurt.de

[10] SHORE & Whariki Research Centre, Massey University, P.O. Box 6137, Wellesley Street, Auckland, New Zealand, C.Wilkins@massey.ac.nz

Corresponding author: Pekka Hakkarainen, E—mail pekka.hakkarainen@thl.fi, Mobile phone +358 29 524 7161, Postal address National Institute for Health and Welfare (THL), Alcohol, Drugs and Addictions Unit, P.O. Box 30, FI-00271, Helsinki, Finland.

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Abstract

Aim – To compare characteristics of recreational vs medical growers in a sample of small-scale cannabis cultivators from 12 countries.

Methods – 6,896 respondents who took part in an online survey were divided into three groups: those who reported growing for recreational use, those cultivating for medical purposes who also reported use of other illegal drugs, and those who reported cultivation for medical use and didn't use other illegal substances. The groups were compared using multinomial logistic regression.

Findings – In comparison to recreational growers, the two groups of medical growers included more females, consumed cannabis more frequently, and were more likely to cite health-related motivations for growing. The medical growers without other illicit drug use shared some of the same features with the medical growers with illicit drug use, but in comparison to both other groups, they were older, used less alcohol and tobacco, and were less likely to be involved in illicit activities other than drug crimes.

Conclusions – Findings suggest that claims of medical use are not simply an attempt to justify personal cannabis consumption, but do at least partly reflect a genuine belief in medical benefit. However, those growing cannabis for medical reasons form a heterogeneous group of people.

Keywords: *cannabis, cultivation, medical use, recreational use, normalization, international study, online survey*

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Introduction

The use of cannabis for therapeutic purposes has been legalised or decriminalized in many jurisdictions (Newton-Howes, 2017). The renewed interest in medical cannabis is, however, hotly debated (Whiting et al., 2015, Wilkinson & D'Souza, 2014). A key controversy in the debate is the relationship between medical use and recreational use. In contrast to therapeutic effects in medicinal use, recreational use is motivated by the psychoactive components of cannabis and the enjoyment and pleasure these can produce, usually described as the experience of getting 'high'. Opponents of medical cannabis argue that most of those who define themselves as medical cannabis users are simply justifying their recreational use by claiming medical purposes (Eisenstein, 2015; Wilkinson & D'Souza, 2014). Indeed, in the US some users have acquired a medical cannabis license as insulation from the criminal law and the stigma attached to a drug arrest and criminal record (O'Brien, 2013). However, research suggests that while typically self-medicating without authorisation, many medical cannabis users are treating health conditions diagnosed by a doctor (Hakkarainen et al., 2015). In fact, for many medical users, cannabis serves as a substitute for conventional medicine (Coomber et al., 2003; Dahl & Frank, 2011; Reiman, 2007; Reinarman et al., 2011; Ware et al., 2005).

In practice, there are a lot of difficulties in defining when people are using cannabis for medicinal reasons and when it is recreational. Therefore, some scholars have suggested that medical and nonmedical should not be viewed and employed as exclusive terms, but rather as a continuum (Reinarman et al., 2011). Indeed, the motives for recreational use and medicinal use of cannabis can be very similar at times. People who are severely ill may not rely on cannabis solely for managing the debilitating symptoms of their medical conditions, but also use it to improve their general sense of well-being (Coomber et al., 2003;

Waissengrin et al., 2015). Additionally, there may be recreational users with mild mental or physical symptoms (e.g. depressive disorders or discomfort) which are unintentionally treated with cannabis.

Moreover, the definitional distinction is further complicated by the fact that there is a significant overlap between medicinal and recreational cannabis users in that many cannabis users who define themselves as medical users also report recreational use (Athey et al., 2017; Pedersen & Sandberg, 2013). In a recent nationwide web-survey in the US 10.5% of current users of cannabis reported medicinal-only use, 53.4% recreational-only use, and 36.1% reported both (Schauer et al., 2016). Yet, there is also a political dimension. As seen in some US states, medical cannabis programmes may develop into wider cannabis control reforms and the legalisation of recreational use (Fischer et al., 2015).

While the blurred boundaries between medical and recreational cannabis play an important role in the debate, systematic research is largely lacking (Reinarman et al., 2011; Sznitman & Zolotov, 2015). For example, very little research has so far examined whether those who use cannabis for medical reasons differ from those who use it for recreational reasons (Lin et al., 2016; Pacula et al., 2016). However, in the US Pacula et al., (2016) found that respondents using cannabis for medical purposes were more likely to vaporise and consume edibles, reported consuming larger quantities, and spent more money per month than recreational users (Pacula et al., 2016; see also Lankenau et al., 2017). Another US study revealed that there were no significant differences between recreational and medical cannabis users in race, education, past year depression and prevalence of cannabis use disorders, while medical cannabis users were more likely to have poorer overall health and higher prevalence of daily cannabis use (Lin et al., 2016). Similar findings have been reported in other studies (Compton et al., 2017; Loflin et al., 2017; Richmond et al., 2015; Roy-Byrne et al., 2015; Woodruff & Shillington, 2016).

There is also evidence indicating that the use of alcohol may be less prevalent among medical cannabis users than among recreational users (Compton et al., 2017; Lin et al., 2016; Pacula et al., 2016). Studies targeting those who have authorised access to medical cannabis also report lower prevalence of other illicit drugs use than recreational users (Lin et al., 2016; Richmond et al., 2015) while studies relying on self-

identified therapeutic use show equal or even higher prevalence among medical cannabis users (Ogborne et al., 2000; Roy-Byrne et al., 2015). Furthermore, a recent study in Israel (Sznitman, 2017) found that there were more variables distinguishing unlicensed from licensed users than there were distinguishing features between unlicensed and recreational users. Recreational users were less likely to use frequently and alone or before midday than unlicensed users. Licensed users reported less hours feeling stoned, fewer cannabis use problems and they were more likely to report cannabis use patterns analogous of medication administration for chronic problems (frequent use, vaping, use alone and use before midday) compared to recreational users.

This article contributes to the existing research by exploring some additional variables to examine the boundaries between medical and recreational cannabis. Specifically, we compare groups of small-scale cannabis cultivators growing for recreational or medical reasons regarding their demographic background (age and gender), their frequency of cannabis use, their use of alcohol and tobacco, and their engagement in other illegal activities. We also make a further addition to the literature by contrasting medical cannabis growers who report other illicit drug use with those who do not.

This is the first study to compare cannabis growers cultivating for medical versus recreational purposes. Small-scale cannabis cultivators, who grow cannabis for their own use, form a particular group of cannabis users. They are an important group to study because: (1) many people who cultivate cannabis give 'medical use' as a reason for growing the plant; (2) much of the existing literature on medical cannabis is limited to 'authorised medical cannabis user' samples; (3) existing medical cannabis regimes differ with regards to whether supply via self-cultivation is allowable under the regulations (Hakkarainen et al., 2015; Hough et al., 2003). Furthermore, growers are a particularly important group of cannabis users since they are likely, on average, to be more knowledgeable about cannabis than a typical user, and our sample of cannabis cultivators represents mostly regular or heavy users of cannabis (Potter et al., 2015).

In contrast to within-country studies, almost entirely limited to the US, our data comes from a web survey carried out by the Global Cannabis Cultivation Research Consortium (GCCRC) in twelve countries (Australia,

Austria, Belgium, Canada, Denmark, Finland, Germany, Israel, the Netherlands, Switzerland, the UK and the US, N=6,896). Close to half (44%) of the respondents reported that they were growing to provide themselves with cannabis for medical reasons.

At the time of surveying, some of the countries involved in the study (Canada, Israel, the Netherlands and some US states) allowed relatively wide and well-established legal access to medical cannabis while others, (Australia, Austria, Belgium, Denmark, Finland, Germany, Switzerland and the UK) had little, if any, legal access to cannabis for medical purposes. Most of the medical cannabis users in our sample, especially in countries where access to legal cannabis was strongly restricted, were self-medicating for a wide range of conditions without any medical prescription or recommendation from a doctor (Hakkarainen et al., 2015).

Method

Data

The data for the study was gathered during 2012 and 2013 except in Israel where the survey was carried out in 2015. Data gathering was based on the International Cannabis Cultivation Questionnaire (ICCQ) developed by the GCCRC to measure patterns of small-scale cannabis cultivation (Decorte et al., 2012). The methodology of the GCCRC study has been described in depth elsewhere (Barratt et al., 2012; Barratt et al., 2015).

A broad-based recruitment strategy was used to maximise the heterogeneity of respondents. In practice recruitment of cannabis growers into the study was more challenging in some countries than in others. Differences in sample size and selection through differences in recruitment methods (as described in Barratt et al., 2015; Potter et al., 2015) may explain the variation in the presence of different types of growers in the national samples. Therefore, instead of focussing on country comparisons we controlled for country in subsequent analyses.

There is evidence that subjects responding to web surveys are comparable to those responding to traditional modes of data collection based on voluntary participation (Van Gelder et al., 2010). Our

internet-based methodology provided us with larger samples of cannabis cultivators than we would have been able to recruit using traditional survey research methods (Barratt et al., 2015; Potter et al., 2015). Eligibility criteria for inclusion in the analysis were that the respondent had to have been at least 18 years of age, had grown cannabis during the past five years, and had completed at least 50% of the questionnaire (Barratt et al., 2015). The number of eligible respondents across the twelve countries totalled 6,896.

Measurements

To measure growing for medical purposes the respondents chose as many answers as relevant for describing their motivations for growing from a total of 22 responses (Potter et al., 2015). Two of the response options concerned medical growing. They were "to provide others with cannabis for medical reasons", and "to provide myself with cannabis for medical reasons". Those respondents who indicated that they grew cannabis "to provide myself with cannabis for medical reasons" (N=2,985) were used to define the group of *medical cannabis growers*. Those who provided just others (N=274) were excluded from the analysis. The group of *recreational growers* (N=3,637) constituted those who did not report providing either themselves or others with cannabis for medical purposes. Since our sample consists of people who tend to be frequent users of cannabis it is plausible that the sample also includes problematic heavy users whose patterns of use do not fit very well in either the category of medical use or of recreational use. Nevertheless, there is some evidence implying that there is no significant difference in the prevalence of cannabis use disorders in those two groups (Lin et al., 2016).

To take into account the blurred boundaries between medical and recreational practices the total group of medical cannabis growers was split in two subgroups: medical growers who reported other illicit drug use and medical growers without other illicit drug use. In the questionnaire, the respondents reported use of a variety of different substances used in the past 12 months. Respondents who reported that they were providing themselves with medical cannabis but also reported the use of amphetamines, ecstasy, cocaine or any other illicit drug were coded as *medical growers with other illicit drug use* (N=1,026). Growers who were providing themselves with medical cannabis and *did not* report use of any other illicit substances were

classified as *medical growers without other illicit drug use* (N=1,959). While accepting that one can use one drug (e.g. ecstasy) recreationally and another (e.g. cannabis) for medical reasons, for methodological purposes we assumed that the use of other illicit drugs was indicative of general recreational drug use, including that of cannabis. Our focus in this article, then, is on those who were growing cannabis for medical purposes. On this account we didn't categorise recreational growers similarly in two different groups. However, a sensitivity analysis, where recreational growers were divided into those with other illicit drug use (N=1,328) and those without other illicit drug use (N=2,309), was conducted, but it did not change the main results. Actually, the only visible difference between the groups was in the use of other illicit drugs.

Questionnaire respondents were asked to estimate their *frequency of cannabis use* by reporting on how many days they used cannabis in the past 30 days. *Alcohol use* and tobacco *smoking* were reported for the past 12 months. Similarly, the respondents were asked whether they had engaged in any illegal activity in the past 12 months, other than cannabis and illicit drug use, and cultivation or selling of cannabis. Engagement in violations (non-criminal offences like fare evasion, traffic violations), property crimes (e.g. burglary, fraud, theft, blackmail) and violent offences (e.g. assault, stabbing, rape) in the past 12 months was asked separately. In the analysis, these questions were used as indicators of *engagement in other criminal activities*.

Furthermore, the groups were compared in regard to *motivation for growing*. Excluding the motives of growing for medical purposes, two compound variables – *health motivation* and *other motivation* – were constructed from the remaining 20 response options. In the category of *health motivation* we included four items: "the cannabis I grow is healthier than the cannabis I can buy"; "the cannabis I grow is a more consistent product than the cannabis I can buy"; "I can flush the cannabis I grow to remove chemical residue"; and "the cannabis I grow is stronger than the cannabis I can buy". The last option was included in the health category because there are some indications that medical users, probably due to efficacy, are likely to prefer more potent varieties of cannabis (Dahl & Frank, 2011). Respondents who expressed at least

three out of these four were placed in the category of *health motivation* and the rest of the respondents in the category *other motivation*. In the questionnaire, other motivations included alternatives like "to avoid contact with criminals", "growing your own cannabis is not as risky as buying it", "so I can share it with / give it to my friends and acquaintances", and "so I can sell it" (Potter et al., 2015).

Analysis

Cross-tabulations were used to describe the distributions of different explanatory variables among the three groups of cannabis growers (Table 1). Pearson's Chi-square Test for independence was used for categorical variables and Kruskal-Wallis Test for continuous variables.

Multinomial logistic regression analysis was used to estimate the associations of these variables with the three groups of cannabis users: 0 = recreational growers, 1 = medical growers with other illicit drug use, 2 = medical growers without other illicit drug use. The group of recreational growers was used as a reference, and the results are presented as odds ratios (OR) and their 95% confidence intervals (CI). *P*-value < 0.05 was considered statistically significant.

In the multinomial logistic regression analyses, first the associations between demographic background and reasons for growing were analysed (Table 2). Second, we analysed the associations of the frequency of cannabis use, alcohol drinking, tobacco smoking, motivation for growing and engagement in other illicit activities with the three cannabis grower groups while the model was adjusted for age, gender and country (Table 3).

Results

As Table 1 shows, the three groups differed from each other in many respects. Beyond demographic differences it is noteworthy that compared to other groups a significantly smaller proportion (66%) of medical growers without other illicit drug use had used alcohol in the past 12 months, but the same proportion (66%) had used cannabis daily or almost daily in the past month. Interestingly, among the

medical growers with other illicit drug use the prevalence of drug use was much higher than among the recreational growers.

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Table 1
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Table 2 shows that differences between the three groups in terms of gender and age remained statistically significant after adjusting for other demographic variables. For between country comparisons, the UK, where the proportion of medical growers was 53%, was used as the referent.

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Table 2
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The results in Table 3 indicate that medical growers were more likely to use cannabis daily or almost daily compared to recreational growers. Most notably, the likelihood of daily cannabis use in the past 30 days was almost five times higher among the medical growers with other illicit drug use and three times higher among the medical growers without other illicit drug use than the recreational group. Unsurprisingly, health motivation was also more likely among the two medical growers than in the recreational group. Medical growers without other illicit drug use were significantly less likely than the recreational growers to drink alcohol and to use tobacco. They were also less likely to commit any illicit activities other than drug related. Interestingly, while health motivation for growing appeared to be more likely among the medical growers with other illicit drug use than among the recreational growers, the likelihood of smoking (tobacco) was somewhat higher. The likelihood of drinking was slightly lower among the medical growers

with other drug use. The medical growers with other illicit drug use were more likely than recreational growers to be engaged in any crime, violations, property crimes and, especially, violent offences.

In additional multinomial logistic regression analysis (data not shown in table), when medical growers without other illicit drug use were used as a reference group the odds ratios for medical growers with other illicit drug use were statistically significant in age (0.96, CI 0.95–0.96), alcohol drinking (2.23, CI 1.81–2.74), tobacco use (1.58, CI 1.31-1.89), engagement in any crime (2.93, CI 2.30–3.75), violations (2.75, CI 2.09–3.64), property offences (3.54, CI 1.94–6.48), and violent offences (3.99, CI 1.64–9.72).

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Table 3
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Discussion

Our analysis points to six dimensions which appeared to differentiate recreational growers and the two groups of medical growers defined with regard to other drug use. These are: (1) age, (2) gender, (3) frequency of cannabis use, (4) other drug use, (5) motivations for growing cannabis, and (6) criminal involvement.

First, the group of medical growers without other illicit drug use was somewhat older than the other two groups. This appears reasonable in the sense that health problems tend to increase with age. Similarly, some medical growers might have matured out from recreational motives with age (Athey et al., 2017). Younger people, on the other hand, tend to be more inclined towards recreational practices and experimenting with different kinds of drugs. Previous studies have also found that cannabis users who report "medical use only" (Compton et al., 2017), licensed medical users (Sznitman, 2017) and "medical use recommended by a doctor" (Lin et al., 2016) were of older age.

Second, even though small-scale cannabis cultivation is typically a male dominated activity, the proportion of females was higher in both groups of medical growers than among recreational growers. While females are generally less likely to be regular cannabis users than males, the gender imbalance is less pronounced when it comes to medical use of cannabis (Sznitman, 2017). This finding may reflect the fact that, in general, women tend to be more interested than men in alternative medications and self-help practices (Molassiotis et al., 2005).

Third, medical growers consumed cannabis more frequently than recreational growers. This finding is consistent with earlier studies conducted in the US (Compton et al., 2017; Langenau et al., 2017; Lin et al., 2016; Pacula et al., 2016; Richmond et al., 2015; Roy-Byrne et al., 2015; Woodruff & Shillington, 2016) and Israel (Sznitman, 2017). One explanation might be that using cannabis as medicine for illnesses, injuries or other conditions may demand more continuous, often daily, consumption than using for recreational purposes, which may be mostly limited to leisure-time. As qualitative studies have shown, medical cannabis users, unlike the spontaneity typically involved in recreational use, deliberately monitor and titrate their use to optimise its therapeutic effect (Bottorff et al., 2009; Dahl & Frank, 2011).

Fourth, there are significant differences between the three groups of cannabis growers in terms of their levels of alcohol and tobacco consumption. That is, the group of medical growers without other illicit drug use reported much more moderate consumption of alcohol and tobacco than in the two other groups. This too is consistent with the findings of previous studies (Compton et al., 2017; Lin et al., 2016; Pacula et al., 2016).

Fifth, in terms of the motivation for growing, the groups differed largely as expected since the two groups of medical growers preferred reasons connected to health aspects of the quality of the product (healthier, more consistent, flushable) and efficacy (stronger potency) compared to the recreational growers. This suggests they saw the cultivation of their own cannabis plants as a healthier and better solution than buying it from illicit markets. Differences in motivations may also reflect differences in health conditions. As previous studies show medical cannabis users are likely to suffer more medical problems and poorer

general health than recreational cannabis users (Compton et al., 2017; Loflin et al., 2017; Lin et al., 2016; Roy-Byrne et al., 2015).

Sixth, although criminality beyond cultivation and other drug crimes among the small-scale cannabis cultivators in our sample was relatively low, the recreational growers and medical growers with other illicit drug use showed a distinctly higher criminal involvement than the medical growers without other drug use. This connection has not been studied previously. Differences in criminal involvement may reflect differences in lifestyles between the groups. The recreational growers and medical growers with other illicit drug use may participate, for example, more in the night-time economy that may predispose or expose them to greater involvement in other illicit activities (see e.g. Newton & Felson, 2015), or may be generally more likely to be rule breakers, than those growers in the medical only group.

Importantly, it can be noted that the two groups of medical growers shared some common features but differed clearly from each other in other respects, most notably in age, alcohol consumption, smoking and engagement in (other) illicit activities. A characteristic which clearly makes a difference is the use of other illicit drugs. Recognising the high prevalence of drinking and smoking, regular use of cannabis and a wide variety of other drug use, the group of medical growers with other illicit drug use seemed to consist mainly of genuine poly-substance users. Consequently, it is possible that at least some of them were utilising the therapeutic potential of cannabis to alleviate outcomes of other substance use like treating hangovers after excessive drinking or calming down after a period of stimulant use. For some, the medical use of cannabis might also have been interrelated with spiritually or therapeutically motivated use of psychedelics (e.g. magic mushrooms and LSD), but, for the most part, this can be seen as showing a more general orientation towards recreational drug use and connected lifestyles. According to previous studies the prevalence of other drug use might be higher among unauthorised populations of medical cannabis users (Ogborne et al., 2000; Roy-Byrne et al., 2015). In our sample, which covered self-identified users who grew cannabis, the group of medical growers without other illicit drug use was clearly larger than that who also used other drugs.

Regardless of the findings of this study, boundaries between medical and recreational cannabis remain blurred and more research is needed, not least because of its ongoing political relevance. Among the jurisdictions involved in the study these issues are strongly debated especially in those countries which have only limited access to medical cannabis like Australia, Austria, Belgium, Denmark, Finland, Germany, Switzerland and the UK. At the time of surveying, some pharmaceutical cannabis products like Marinol® and Sativex® were available in all these countries except Australia. Products of herbal cannabis (e.g. Bedrocan®) were accessible in Finland and Germany with special authorization, and there were a few ongoing clinical trials in the UK. In general, access to cannabis treatment was strictly regulated and predominantly limited to certain specified medical conditions. Since then, however, some changes have taken place. In Australia, for example, the government is undertaking several legislative and regulatory changes to facilitate access to approved medical cannabis products, including cannabis extracts (e.g. oils, tinctures) to appropriate patients for treatment of a defined set of medical conditions where there is evidence to support their use. However, unlike in some other countries, the intention is to provide a scheme for products containing derivatives of cannabis rather than a pathway for legal availability of herbal cannabis plant material for therapeutic use. In Denmark, a four-year trial with medical cannabis is due to start in January 2018 which allows patients to use extracts from the cannabis plant (e.g. in tea) as medicine, if they have problems related to sclerosis, symptoms related to chemotherapy, symptoms related to paraplegia, or chronic pains that no other drug can help. In Germany, herbal cannabis for medicinal use was formally legalized in March 2017, and the law also directs that the costs of prescribed cannabis should be covered by health insurance. In the UK, the Medicines Healthcare Regulatory products Agency has announced that cannabidiol CBD products used for medical purposes are recognized as medicine. In Austria and Switzerland cannabis products of high CBD but low THC (up to 1 %) are allowed on the market. Furthermore, in several countries there are or have been different kinds of working groups investigating options for a legal access to medical cannabis, and the media have reported individual stories of people using cannabis for medical purposes. In some countries with established legal access to medical cannabis, like Israel and the Netherlands, cannabis remains a liminal substance, both a legitimate medicinal

alternative and an illicit drug. In some other jurisdictions, like particular US states and Canada (from 2018), access to both medical cannabis and recreational cannabis has been made legal.

It is critical that the concept of growing (or using) for 'medical purposes' doesn't become so broad as to end up with a catch-all term or a justification for what would actually be viewed as recreational motivation, particularly in legal contexts where cannabis cultivation and use would otherwise be subject to strict criminal penalties. At the same time, there is a risk that the term 'medical cannabis' is restricted to a narrow band of approved treatment for a limited number of medical conditions which would result in much of the self-reported cultivation for medical reasons in this study being deemed invalid, despite the benefits reported by those claiming medical use (Hakkarainen et al., 2015).

A particular concern with cannabis growing is the potency and balance of constituent active ingredients of the product. Potency is usually measured in terms of THC content, THC (delta 9-tetrahydrocannabinol) being the major psychoactive ingredient in cannabis. Findings of forensic studies suggest that potency of domestically cultivated cannabis varies largely over time and place, but in general it has been found to have higher THC-concentration than cannabis resin imported from traditional producer nations (Møller & Lindholst, 2014; Potter et al., 2008). There is evidence that the use of high potency cannabis may increase the risk of various mental health problems, although patterns of use rather than product smoked are more important in potentiating mental health problems (ACMD, 2008). However, evidence also suggests that CBD (Cannabidiol) has anti-psychotic properties which can off-set some of the mental health problems associated with THC (Fakhoury, 2016) and as such THC/CBD ratios rather than absolute THC levels may be more important here.

Since medical growers tend to use cannabis more frequently than recreational growers they may also have a greater risk of the clinical implications associated with high potency. On the other hand, self-cultivation allows for greater control over the cannabis produced. Decorte (2010) found a preference for *weaker* cannabis than that available on the criminal market to be a commonly cited motivation in a survey of Belgian growers. In assessing the mental health risk implications for medical (and recreational) growers we

need to better understand the THC and CBD content of the cannabis they are producing. For example, do medical growers prefer varieties with a higher CBD-concentration over varieties with a high THC/CBD ratio. In our survey this question was left unclear, since medical growers reported that both healthier product and stronger potency were important reasons for growing. THC/CBD ratio is an important issue to be taken account in harm reduction and prevention.

Finally, this study suggests that, particularly at this time of emerging legal recreational and medicinal cannabis markets, differentiating between the nuances of medical versus recreational motivations should be an important part of future research on cannabis use and growing. As Lancaster and collaborators argue from a poststructuralist perspective "medical cannabis relies on the 'absent presence' of recreational cannabis", and, in fact, the making of these objects through a complex network of relations and practices is mutually co-constitutive (Lancaster et al., 2017, p. 7; see also Duff, 2017). That is, without the concept of recreational cannabis, the concept of medical cannabis does not exist, and vice versa. Indeed, recreational and medical reasons for engaging in this activity are not necessarily mutually exclusive and there appears to be a group of growers and users who engage in both activities. Further qualitative research with cannabis users on mixed motivation and, more generally, the relationships between therapeutic effect and pleasure would provide an important contribution to the literature.

A central limitation of web survey methodology is that we cannot measure the representativeness of the data (Barratt et al., 2015). However, whilst the data cannot be said to represent all cannabis growers, and even less all cannabis users, 6,896 eligible respondents provided a substantial sample for analysis – and representative samples of hidden populations are, by definition, impossible to achieve (Barratt et al., 2017). Furthermore, one shortcoming of our questionnaire was that we didn't ask detailed questions about reasons for cannabis *use* in addition to reasons for growing and as such we were forced to use a proxy measure to classify different groups and interpret their meaning. Consequently, we may have incorrectly classified some medical growers who were dedicated to cannabis use and avoided other drugs, but used cannabis not only for medical purposes but also for recreational purposes. Hence, our categorization most

probably does not cover all the overlap between medical and recreational cannabis growers. We acknowledge that having recreational use as a response option for reason for growing would have better enabled us to analyse recreational motives among the medical growers in more detail. Also, while some studies have found no significant difference in the prevalence of cannabis use disorders among recreational users and medical users (Lin et al., 2016), another limitation of our study is that we did not measure respondents' overall levels of cannabis use, and were therefore unable to include heavy problematic use in our models. Inclusion of recreational use as a motivation for growing and measures of heavy and problematic cannabis use will be included in future versions of the ICCQ.

In conclusion, there are measurable differences between groups of medical and non-medical growers sufficient to suggest that claims of medical use are not simply an attempt to justify personal cannabis consumption and cultivation, but do at least partly reflect a genuine belief in medical benefit. However, those growing cannabis for medical reasons form a heterogeneous rather than a homogeneous group of people covering a range of intentions, habits and norms. A characteristic which clearly makes a difference is the use of other drugs. Further qualitative research working with cannabis users to explore mixed recreational and medical motivations and, more generally, the relationships between therapeutic effect and pleasure, would provide an important contribution to discussions about cannabis policy reform globally.

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Legends

Table 1. Differences between groups of recreational growers, medical growers with other illicit drug use and medical growers without other illicit drug use by gender, age, country, substance use, cannabis use during the last month, motivations for growing and engagement of other illicit activities

Table 2. Modelling of demographic characteristics of recreational cannabis growers, and medical growers with and without other illicit drug use

Table 3. Modelling patterns of cannabis use, alcohol consumption, tobacco smoking, motivations for growing and engagement in other illicit activities of recreational cannabis growers, and medical growers with and without other illicit drug use, controlling for demographic characteristics