

Chapter 8

Harm reduction policies for cannabis

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Abstract

This chapter reviews the limited evidence on strategies for reducing the harms arising from cannabis use and from criminal penalties to control its use. It summarises evidence on the harms arising from cannabis use, namely, increased risks of: car crashes among users who drive while intoxicated; the development of cannabis dependence among regular users; psychosis and poorer adolescent psychosocial outcomes; and increased risks of respiratory disease from smoking. Strategies for reducing these risks to users are described, such as, roadside drug testing to deter cannabis-intoxicated driving, and education of users about patterns of use that increase risks of dependence, poor mental health and respiratory problems. The chapter also briefly discusses depenalisation and decriminalisation of cannabis use as strategies to reduce harms arising from cannabis prohibition. It concludes with suggestions for research priorities in how to reduce harms arising from cannabis use and the policies adopted to reduce such use.

Keywords: cannabis-impaired driving, cannabis dependence, respiratory risks, cannabis decriminalisation.

Introduction

Cannabis is the most widely used illicit drug globally, and its use has increased over the past decade. In 2005, around 160 million adults (4 % of the global adult population) were estimated to have used cannabis in the previous year, 10 % more than in the mid 1990s (UNODC, 2007). In the recent World Mental Health Surveys, the lifetime use of cannabis was higher in the United States and New Zealand than in Europe, which, in turn, reported higher rates of use than the Middle East and Africa or Asia (Degenhardt et al., 2008). Because of their larger populations, Asia, Africa and the Americas account for an estimated 31 %, 24 % and 24 % of global cannabis use compared to 19 % in Europe and 2 % in Oceania (UNODC, 2007).

In the United States in 2005, 40 % of the adult population reported using cannabis at some time in their lives and 13 % of adolescents reported use in the past year (SAMHSA, 2006). Cannabis use in most countries begins in the mid to late teens and is most common among people in their early 20s (Degenhardt et al., 2008). Most use is intermittent and time-limited (Bachman et al., 1997), with about 10 % of those who ever use cannabis becoming daily users, and another 20 % to 30 % using weekly (Hall and Pacula, 2003). Cannabis use declines from the early and mid 20s to the early 30s, reflecting major role transitions in early adulthood (e.g. entering tertiary education or full-time employment, marrying, and having children) (Anthony, 2006; Bachman et al., 1997).

Cannabis use in Europe

Cannabis is the most widely used illicit drug among European adolescents and its use is so common that it has been described as an 'illegal everyday drug' (Essau, 2006). In the late 1990s and early 2000s, the median rate of lifetime cannabis use among European adults aged between 18 and 64 years was 15 %, with a range between 31 % in the Czech Republic and 2 % in Romania (EMCDDA, 2006). Rates of lifetime use were higher among younger adults (aged between 15 and 34 years), with a median rate of 21 %, and a range between 3 % in Romania and 45 % in Denmark (EMCDDA, 2006).

Smart and Ogborne (2000) have summarised data on illicit drug use among high school students in 36 European countries during the mid-1990s (circa 1995). The highest prevalence of lifetime cannabis use was found in Scotland (53 %), which was higher than the overall prevalence in the United Kingdom (41 %), followed by the Netherlands (22 %). These rates increased during the 1990s in those countries that have undertaken a series of surveys over that time, namely, the Netherlands, Switzerland, and Norway (Harkin et al., 1997). These trends mirror those in Australia, Canada and the United States (Room et al., 2008).

More recent survey data collected by EMCDDA suggests that cannabis use rates have increased throughout Europe since then, and have recently begun to stabilise. Out of a total population of almost 500 million, 74 million Europeans aged 16 to 64 years have had lifetime experience with cannabis, 23 million in the past year, and 12 million in the past month (see the General Population Survey Tables in EMCDDA, 2009). Highest rates of use were in young adults aged 15–34 years (31 % lifetime, 13 % past year). These rates vary between countries (ranges 3 %–50 % and 1 %–21 % respectively). Average European rates were lower than in the United States (49 % and 21 %), Canada (58 % and 28 %) and Australia (48 % and 20 %) in the mid 2000s.

The probable harms of cannabis use

As argued in more detail elsewhere (Hall and Pacula, 2003; Room et al., 2008), there is reasonable evidence that cannabis use can harm some users. In this chapter we summarise the evidence on those adverse effects most commonly attributed to cannabis use and best supported by epidemiological evidence. We then describe strategies that could be used to reduce these harms arising from cannabis use. We also briefly discuss alternative policy approaches that aim to reduce harms arising from current criminal control policies towards cannabis use.

Cannabis and motor vehicle crashes

Cannabis intoxication produces dose-related impairments in cognitive and behavioural skills that may affect driving (Mannet et al., 2008; Ramaekers et al., 2004; Solowij, 1998). Older studies that measured inactive metabolites of tetrahydrocannabinol (THC) could not assess whether drivers were impaired at the time of accidents (Ramaekers et al., 2004). Recent

studies measuring THC in blood suggest that cannabis-affected drivers are at a higher risk of being involved in crashes (e.g. Drummer et al., 2004; Gerberich et al., 2003; Mura et al., 2003). Cannabis use appears to increase the risk of motor vehicle crashes by two to three times (Ramaekers et al., 2004) compared with 6 to 15 times for alcohol. It has been estimated that cannabis-affected driving accounted for 2.5 % of fatal accidents in France, compared to 29 % for alcohol (Laumon et al., 2005).

Cannabis dependence

A cannabis dependence syndrome develops in some daily or near-daily users of cannabis (Budney, 2006; Roffman and Stephens, 2006). Cannabis dependence is characterised by marked distress resulting from impaired control over cannabis use and difficulty in ceasing use despite harms caused by it. After tobacco and alcohol, cannabis was the most common form of drug dependence in the US in the 1990s and early 2000s (Anthony, 2006) and in Australia in the late 1990s (Hall et al., 1999). The risk of developing cannabis dependence in the United States is similar to that for alcohol but lower than that for nicotine and the opioids (Anthony et al., 1994). Around 10 % of those who ever use cannabis meet criteria for dependence (Anthony, 2006). This rises to 16 % in persons who initiate in early adolescence (Anthony, 2006).

Over the past two decades, increasing numbers of people have sought professional help for their cannabis use in the United States, Europe and Australia (Hall and Pacula, 2003). In Europe in 2006 there were 390,000 requests for treatment for cannabis dependence (EMCDDA, 2008). This was 21 % of all cases requesting assistance for illicit drugs and second only to opioids (EMCDDA, 2008). Some of this increase may be explained by increased diversion of cannabis users apprehended by the police into treatment programmes, but not all, because increases have also occurred in the Netherlands where cannabis possession has been decriminalised de facto (Dutch National Alcohol and Drug Information System, 2004).

Cannabis and schizophrenia

A 15-year prospective study of 50 465 Swedish conscripts (Andréasson et al., 1987) found that the risk of schizophrenia increased with the number of times cannabis had been used by age 18. A 27-year follow-up of the same cohort (Zammit et al., 2002) also found a dose-response relationship between frequency of cannabis use at baseline and risk of schizophrenia during the follow-up. These relationships persisted after controlling for other drug use and other confounding factors. These findings have been supported by longitudinal studies in the Netherlands (van Os et al., 2002) and Germany (Henquet et al., 2004) and by two small New Zealand cohort studies (Arseneault et al., 2002; Fergusson et al., 2003). The most plausible explanation appears to be that regular cannabis use acts with a variety of other unknown risk factors to precipitate psychoses in vulnerable individuals (Degenhardt and Hall, 2006; Moore et al., 2007).

The respiratory risks of cannabis smoking

Regular smokers of cannabis who do not smoke tobacco have more symptoms of chronic bronchitis and poorer lung function than people who do not smoke either cannabis or tobacco (see Tashkin, 1999). People who smoke cannabis with or without tobacco also seem to be more susceptible to respiratory infections (Tashkin, 1999).

Cannabis smoke is carcinogenic (Marselos and Karamanakos, 1999), making cannabis smoking a potential cause of cancers of the lung and mouth, tongue, and oesophagus (Hall and MacPhee, 2002). Epidemiological studies of head and neck cancer have produced conflicting results: one case control study found an association (Zhang et al., 1999) but a longitudinal study (Sidney et al., 1997) and two other case control studies failed to do so (Llewellyn et al., 2004; Rosenblatt et al., 2004). Case control studies of cannabis smoking and lung cancer have found associations but they have not been able to separate the effects of cannabis from tobacco smoking because most cannabis users in these studies were also daily cigarette smokers (Mehra et al., 2006).

Potential harm reduction strategies for cannabis

The following sections outline some potential harm reduction strategies for cannabis. Some are based on adaptations of similar policies that have been used to reduce harm from other drugs, such as alcohol. In other cases we outline the type of advice that could be given to users to avoid patterns or practices of use that increase the risk of experiencing adverse health outcomes (Swift et al., 2000). With few exceptions, there is little evidence on their effectiveness. Research into the effectiveness of these proposals should be a priority for harm reduction policies for cannabis.

Motor vehicle accidents

It is obvious that cannabis users can avoid cannabis-related vehicle crashes by not driving while intoxicated, but it is uncertain whether cannabis users have responded to education campaigns that urge them not to drive after using. Australia, Norway and Sweden have adopted random roadside drug testing in an effort to discourage cannabis-impaired driving. In Australia, the Victorian state government introduced random roadside saliva testing for cannabis and other drugs in December 2004; other Australian states and territories have since followed (Butler, 2007). Australian legislators have assumed that this policy will substantially reduce cannabis-related road crashes in the same way that random breath testing reduced alcohol related crashes in Australia (Henstridge et al., 1997). Other European countries have adopted the more focused policy of testing for cannabis in saliva or urine on suspicion of use or evidence of impaired driving (Mann et al., 2008).

The illegality of cannabis use has prompted the adoption of a 'zero tolerance' approach in Australia, Norway and Sweden, with the presence of any detectable amount of THC defined as an offence (Butler, 2007). Any road safety benefits of this policy are a by-product of the deterrent effect of enforcing prohibitive drug laws. Proponents of drug testing argue that it

will save lives (Jones et al., 2008) but so far there is no evidence that it has done so. This policy needs to be properly evaluated to see if it reduces cannabis-impaired driving at an acceptable social and economic cost (Hall and Homel, 2007). Other approaches that focus on harm reduction would include: developing measures of cannabis-impaired driving, as advocated by Grotenhermen et al. (2007), and encouraging cannabis users to adopt 'designated driver' programmes like those advocated for alcohol users.

Cannabis dependence

An essential first step in reducing the risk of cannabis dependence is informing users of the risk. This can be done by explaining that the risk increases with regular use and is greatest when cannabis is used daily for weeks or months, as is true for alcohol and tobacco dependence. Priorities for research include assessing whether users will accept this advice or what the most persuasive way of delivering it would be.

Screening and brief advice for excessive alcohol consumption in general practice, hospital or even non-medical settings reduces consumption and the problems caused by alcohol (e.g. Shand et al., 2003). The same approach could be adopted for cannabis use disorders in primary care settings, for example among young adults with respiratory problems or symptoms of anxiety and depression, all of which are common among cannabis-dependent individuals who seek help from family physicians (Degenhardt et al., 2001).

Similarly, brief interventions for frequent cannabis users could be targeted at populations and/or settings where cannabis use is known to be high, for example youth mental health services, juvenile justice centres, and among college students (Hall et al., 2008a). Such interventions could advise users to reduce the frequency of cannabis use and not to use it before driving. A 'check-up' approach modelled on the Brief Drinker Check-up (Miller and Sovereign, 1989) provides a promising model for raising the issue of health risks of cannabis use in a non-confrontational way (see Berghuis et al., 2006). This approach has been trialled and evaluated with promising results in a number of studies (Martin and Copeland, 2008; Stephens et al., 2007).

The question of how best to inform young people about the risks of cannabis dependence requires research on young people's views about the type of information that they find most persuasive. In the interim the following are suggestions about what advice could be given:

- Cannabis users can become dependent on cannabis. The risk (around 10 %) is lower than that for alcohol, nicotine and opiates, but the earlier that a young person begins the higher the risk.
- Using cannabis more than weekly increases the risks of developing dependence and other health problems.
- Regular use probably also increases the risk of psychosis in young people who have a family member with a psychosis or other mental disorder, or who have unusual psychological experiences after using cannabis.
- Driving within a few hours of cannabis use increases the risk of both fatal and non-fatal motor vehicle accident involvement and should be avoided, especially after drinking alcohol.

Cognitive behavioural therapy can be used to treat cannabis dependence on an outpatient basis. Rates of abstinence have been modest — for example, around 15 % reported continuous abstinence at six-month follow-ups, according to Copeland et al. (2001) — but cannabis use and cannabis-related problems are substantially reduced (Denis et al., 2006; Roffman and Stephens, 2006). A recent review by Nordstrom and Levin (2007) concluded that while a number of psychotherapies have been found to be effective in treating this disorder, none has been found to be more effective than any other, although offering vouchers as a reward to reinforce negative urine toxicology screens improved abstinence during treatment.

Informing young people about the mental health risks of cannabis use

A major public health challenge will be finding effective ways of explaining the mental health risks of cannabis use to young people. In addition to a possible increased risk of psychosis, young people also need to be informed about the risks of developing dependence, impairing their educational attainment, and possibly increasing their risk of depression (Hall, 2006; Patton et al., 2002). These risks add weight to the prudential argument for discouraging cannabis use by young people.

Policymakers need to be realistic about the impacts of educational messages (Caulkins et al., 2004; White and Pitts, 1998). Small, statistically significant reductions in cannabis use may be observed in well-conducted programmes (Caulkins et al., 2004; Gorman, 1995; Tobler, Lessard, Marshall et al., 1999; White and Pitts, 1998) but the primary impact is on knowledge rather than behaviour (White and Pitts, 1998). Any behaviour change is more likely to occur among less frequent rather than heavier users (Gorman, 1995). Given this, the nature and delivery of the advice may need to differ for different groups facing different levels of risk (Toumbourou et al., 2004). The best way to deliver the advice will depend upon good social marketing research on the views of young people (Grier and Bryant, 2005).

Education about the risks of cannabis use should explain the mental health risks of regular intoxication with alcohol and cannabis; and define the high-risk groups, namely those with a family history of psychosis and those who have had bad experiences with cannabis. Such education needs to be directed not only at cannabis users but also at their peers to increase recognition of these problems among young people so that they can encourage affected peers to cease using or seek help earlier than might otherwise be the case.

A major challenge is framing the magnitude of the risk of psychosis. The risk for any individual increases from around 7 in 1 000 (Saha et al., 2005) to 14 in 1 000, but the consequences of psychosis for those individuals who are vulnerable are serious. The temptation for parents and health educators is to play up the risk, arguing that everyone is at risk because it is difficult to predict which young people are most vulnerable. This strategy is of doubtful effectiveness and may undermine the credibility of the message by being seen to exaggerate the risk.

It is prudent to encourage young people who use cannabis and experience psychotic symptoms to stop, or at the very least to reduce the frequency of their cannabis use. The

challenge in implementing this goal is finding effective ways of persuading persons with schizophrenia to stop doing something that they enjoy and to help those who want to stop but find it difficult to do so. Many persons with schizophrenia have characteristics that predict a poor outcome from psychological interventions for cannabis dependence, namely, they lack social support, may be cognitively impaired, are often unemployed, and do not comply with treatment (Kavanagh, 1995; Mueser et al., 1992). There are very few controlled outcome studies of substance abuse treatment in schizophrenia (Lehman et al., 1993). A recent Cochrane review identified only six relevant studies, four of which were small (Jeffery et al., 2004) and found no clear evidence that supported substance abuse treatment in schizophrenia over standard care.

Reducing respiratory risks

The respiratory risks of cannabis smoking could be eliminated if cannabis users adopted eating or ingesting rather than smoking cannabis. This is unlikely to happen, because most long-term users find smoking a more efficient and easier way to titrate their dose of THC than the oral route (Grotenhermen, 2004; Iversen, 2007).

Putatively 'safer' forms of cannabis smoking, such as water pipes, are popular among younger cannabis users in Australia (Hall and Swift, 2000) but United States and Australian (Gowing et al., 2000) research suggests that water pipes deliver more tar per dose of THC than do joints. It is also unclear how much the respiratory risks of cannabis smoking might be reduced if users were to smoke lesser amounts of the more potent cannabis products (Melamede, 2005). There has been too little research to determine whether users can reliably titrate their dose and, if they can, whether in fact they do so (Hall and Pacula, 2003).

It is reasonable to advise cannabis smokers to avoid breath-holding or 'deep inhalation' techniques to maximise the absorption of THC in the lungs. This practice increases the quantities of tar and particulate matter that are retained in the lungs without necessarily increasing the THC delivered. It is also advisable for cannabis users to eliminate the use of tobacco in smoked cannabis preparations because of tobacco's addictiveness and carcinogenicity.

Vaporisers appear to be a more promising way of reducing the carcinogens and toxicants inhaled when cannabis is smoked (Gieringer et al., 2004; Grotenhermen, 2004; Melamede, 2005). These devices are designed to deliver inhaled THC without carcinogens and toxicants. They do so by heating cannabis to a temperature (180°C), which releases THC without burning the plant material. A study by Gieringer et al. (2004) found that vaporisers achieved a similar efficacy in delivery of THC to smoking a cannabis cigarette while very substantially reducing levels of carcinogens. Hazekamp et al. (2006) evaluated the performance of the same device in delivering pure THC and found that it had acceptable safety properties. However, Bloor et al. (2008) found that while vaporisers reduced levels of released ammonia, compared to smoked cannabis these levels (170 ppm) were still well above recommended safe levels (35 ppm) for short-term occupational exposures. These levels of ammonia increase respiratory irritation, but the respiratory effects of long-term intermittent exposure in daily users are unknown.

Abrams et al. (2007) compared the effects of varying doses of cannabis vaporised and smoked in a joint in 18 subjects under double blind conditions. They found that the vaporiser delivered similar amounts of THC and produced similar psychological effects. Sixteen of the 18 subjects preferred the vaporiser. They did not test for delivery of tars and carcinogens but did find lower CO levels in blood when using a vaporiser. Earleywine and Barnwell (2007) found suggestive evidence that vaporisers had reduced respiratory symptoms in a convenience sample of 6 883 cannabis users interviewed via the Internet. The rate of respiratory symptoms (bronchitis, wheeze, breathlessness) among the 150 who reported only using vaporisers was 40 % of that reported by cannabis smokers (after controlling for cigarette smoking, duration of use and amount typically used). The reduction in symptoms among vaporiser users appeared to be larger in heavier cannabis users. More work is needed to evaluate the long-term safety and efficacy of vaporisers in reducing the respiratory risks of cannabis use.

Reducing the harms arising from cannabis control policies

Under current criminal cannabis control policies in many European and other developed countries, cannabis users can nominally be sentenced to prison if caught in possession of cannabis. Even if prison sentences are rarely imposed, the acquisition of a criminal conviction or record for the personal use of cannabis can adversely affect the lives of otherwise law-abiding users (Lenton, 2000) in ways that some have argued are more serious than any harms that result from using cannabis (Wodak et al., 2002), for example, by impeding professional or travel opportunities and adversely affecting personal relationships (Room et al., 2008). The limited research (Erickson, 1980; Lenton et al., 1999a; Lenton et al., 1999b) suggests: that many persons convicted of cannabis offences have no other criminal records; that a criminal conviction adversely affects their employment prospects and their reputations; and that it has a negligible effect on their cannabis use.

The enforcement of cannabis control laws is also often applied in a highly selective, if not discriminatory, way. In Australia in the early 1990s cannabis offenders appearing before the criminal courts were more likely to be unemployed and socially disadvantaged males than were cannabis users in community surveys (Advisory Committee on Illicit Drugs, 1993). Recent US studies show higher rates of arrests for cannabis offences among Hispanic and Black minorities (Gettman, 2000; Human Rights Watch, 2000). It is uncertain to what extent the same is true in European countries with substantial ethnic minorities or immigrant populations.

The non-enforcement or removal of criminal penalties for personal use is one way of reducing the adverse effects of the law on users. The Netherlands was one of the first European countries to do so in 1976 (see box 'De facto cannabis decriminalisation in the Netherlands', p. 243), and Portugal has more recently done so among other European countries (see box 'Cannabis decriminalisation in Portugal', p. 243). In several Australian states, personal cannabis use is subject to a non-criminal 'infringement' or 'expiation' notice, an offence similar to a speeding ticket and punished by a limited fine (Room et al. 2008). Studies of the impact of these changes have typically found that reductions in the severity of penalties for cannabis use have little, if any, impact on rates of population cannabis use in

Australia (e.g. Donnelly et al., 1999), the United States (Pacula et al., 2004) and Europe (Greenwald, 2009; Room et al., 2008). The lack of any evidence of a large impact on rates of use also suggests that this policy may have little or no effect on cannabis-related harms, while at the same time reducing enforcement costs and effects on users (Room et al., 2008).

De facto cannabis decriminalisation in the Netherlands

The Netherlands decriminalised cannabis possession for personal use on a 'de facto' basis from 1976. This means that while personal possession is still formally prohibited by criminal law, the law is not enforced. The Dutch system tolerates cannabis users possessing and buying small amounts of cannabis for personal use, most notably in several hundred 'coffee shops' across the country. Also in the Netherlands, no major changes in cannabis use rates have been observed that could be unambiguously attributed to this policy, and use rates are lower than the EU average. This approach aims to separate the cannabis market from that of other illicit drugs. While this de facto decriminalisation has been well-supported politically and socially in the Netherlands, it has recently come under some pressure from neighbouring countries concerned about 'drug tourism' (Chatwin, 2003; MacCoun and Reuter, 1997; Pakes, 2004; Room et al., 2008). The Dutch government has responded to these concerns by reducing the number of coffee shops and the amount of cannabis that can be sold.

Cannabis decriminalisation in Portugal

Portugal formally decriminalised use of all illicit drugs by changing its drug control laws in 2001. Cannabis use and possession remains illegal but it is treated as an 'administrative violation'. Drug use offenders are brought to the attention of 'Dissuasion Commissions' who typically suspend any punitive proceedings. In serious cases, such as those of repeat offenders, administrative penalties — like fines, suspension of driver's licence or community service orders — can be imposed and problematic users can be referred to treatment. Since these reforms, no significant changes have been observed in cannabis use, which remains low compared to other EU countries and North America. The number of drug use infractions has been stable since the reforms, which have been well-accepted politically and by the general public (Greenwald, 2009; Hughes and Stevens, 2007; Room et al., 2008).

An unintended consequence of depenalisation via civil penalties can be an increase in numbers of persons fined or diverted into non-criminal interventions (e.g., education or treatment measures) by the police, an effect referred to as 'net widening'. This occurs because the police find it easier and less time-consuming to enact non-criminal measures (e.g. impose a fine) than to formally arrest and process a criminal charge. If a substantial proportion of offenders do not pay their fines, more cannabis users may end up in prisons for fine-default than would be the case if cannabis use remained as a criminal offence (Room et al., 2008). The removal or the non-enforcement of any penalties for personal use (as in the Netherlands) avoids this problem (Hall and Pacula, 2003; Room et al., 2008), as does allowing non-custodial ways to enforce the payment of fines (Room et al., 2008).

Research priorities for cannabis harm reduction

Research is needed on the effectiveness of these policies that aim to reduce the harms of cannabis use. Among the priorities for future inquiry are the following questions:

- What do cannabis users believe are the harms of using cannabis?
- Does the type of evidence presented about these adverse effects persuade them?
- Are they prepared to act on advice about how to reduce these harms?
- Does roadside drug testing deter cannabis users from driving while intoxicated? If so, does this reduce motor vehicle accident fatalities? Does it do so at an acceptable social and economic cost? Are there better ways than deterrence policies to reduce risks related to cannabis and driving?
- Do adolescent users accept that cannabis use can be harmful? Are they prepared to act on harm reduction advice? Are brief interventions in medical or non-medical settings effective in changing risk patterns of use or practices?
- Does the use of vaporisers substantially reduce the respiratory risks of cannabis smoking?
- Do cannabis users titrate their doses of cannabis products?

Among priorities for research on the effects of harm reduction measures such as depenalisation and decriminalisation are the following:

- Do depenalisation or decriminalisation policies result in changes in patterns or rates of cannabis use, or attitudes towards cannabis use, especially among vulnerable/high-risk populations (e.g., youth/students)?
- Will more tolerant policies for cannabis use reduce access or exposure to other illicit drugs?
- Do decriminalisation approaches result in tangible savings of public resources (e.g., enforcement time) without increasing the prevalence of harmful cannabis use (e.g., numbers seeking treatment for cannabis dependence)?

Conclusions

Cannabis is the most widely used illicit drug in Europe, as it is globally. While cannabis use clearly does not result in harms that are comparable to those of alcohol or tobacco, its use is associated with significant potential risks and harms. Based on existing evidence, a number of these risks and harms are modifiable by harm reduction approaches directed at users. This more pragmatic, 'public health' approach that builds on experiences from the alcohol field requires substantial additional research and policy engagement. Its utility is still hindered by the century-old illegal status of cannabis in most European jurisdictions.

Driving under the influence of cannabis has been given considerable attention in recent years. Governments in Australia, Norway and Sweden have implemented random roadside saliva testing to detect the presence of cannabis in drivers to reduce cannabis-impaired driving and prevent accidents as a primary harm. However, the scope of this policy might be overly punitive in penalising drivers who are not actually impaired by cannabis while driving. Thus, the effectiveness, cost-effectiveness and social effects of this policy remains to be evaluated.

Given the existing knowledge around the acute and long-term harms associated with cannabis use, and key predictors of these effects, there appears to be considerable room for interventions with or advice to cannabis users towards reducing the odds or severity of problems resulting from use. For example, harm reduction advice that could be given to current cannabis users includes the following:

- Avoid more than weekly use to minimise the risks of developing mental health problems or dependence.
- Avoid smoking as a route of administration or use a vaporiser instead, rather than smoke a bong or joint.
- If you smoke cannabis, avoid deep inhalation or breath-holding practices in order to reduce the risks of respiratory problems.
- Do not drive or use machinery when intoxicated.

There is a need for research on how to effectively convey such messages, and to measure their potential impacts on individual and/or population levels of harm from cannabis use.

There is reasonable evidence that removing criminal penalties for personal possession and use of cannabis reduces some of the harms of current control policy incurred by users who come to the attention of criminal control. This policy can reduce the extensive social and economic harms of use prohibition (rather than the effects of cannabis use) without producing large increases in the prevalence of cannabis use, as recent policy reform experiments in a number of countries have suggested. Such efforts would also help to bring cannabis use more into a policy framework of public health rather than repressive control. They may facilitate steps towards a more integrated and rational regulation of all commonly used psychoactive substances guided by their potential to cause harm and evidence on the benefits and costs of different interventions (Nutt et al. 2007).

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