# Lower Risk Cannabis Use Guidelines for Canada (LRCUG): A Narrative Review of Evidence and Recommendations

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## ABSTRACT

**Objectives:** More than one in ten adults – and about one in three young adults – report past year cannabis use in Canada. While cannabis use is associated with a variety of health risks, current policy prohibits all use, rather than adopting a public health approach focusing on interventions to address specific risks and harms as do policies for alcohol. The objective of this paper was to develop 'Lower Risk Cannabis Use Guidelines' (LRCUG) based on research evidence on the adverse health effects of cannabis and factors that appear to modify the risk of these harms.

**Methods:** Relevant English-language peer-reviewed publications on health harms of cannabis use were reviewed and LRCUG were drafted by the authors on the basis of a consensus process.

**Synthesis:** The review suggested that health harms related to cannabis use increase with intensity of use although the risk curve is not well characterized. These harms are associated with a number of potentially modifiable factors related to: frequency of use; early onset of use; driving after using cannabis; methods and practices of use and substance potency; and characteristics of specific populations. LRCUG recommending ways to reduce risks related to cannabis use on an individual and population level – analogous to 'Low Risk Drinking Guidelines' for alcohol – are presented.

**Conclusions:** Given the prevalence and age distribution of cannabis use in Canada, a public health approach to cannabis use is overdue. LRCUG constitute a potentially valuable tool in facilitating a reduction of health harms from cannabis use on a population level.

**Key words:** Canada; cannabis; epidemiology; morbidity; policy; public health

La traduction du résumé se trouve à la fin de l'article.

*Can J Public Health* 2011;102(5):324-27.

More than 10% of the general adult population in Canada report use (largely recreational) of cannabis in the past year, the highest use rate of any illegal drug.[1] Use rates among adolescents and young adults (i.e., 16-29 years of age) range from 26-46%. While cannabis use – like all psychoactive substance use – is associated with possible harms, it is currently governed by a policy of categorical prohibition in Canada.[2] Specifically, the current Controlled Drugs and Substances Act (CDSA) makes 'simple cannabis possession' a criminal offense; 45,000 Canadians (or 1-2% of all estimated past-year users) are arrested annually for this offense.[3] Similarly, current prevention and treatment efforts predominantly aim at abstinence.

The policy approach to cannabis is fundamentally different from current approaches to other popular drugs like alcohol, where a public health approach instead focuses on high-risk users, risky use practices and settings, and especially on modifiable risk factors, to reduce harms to individuals and society.[4] Given that the majority of harms related to cannabis use appear to occur in selected high-risk users or in conjunction with high-risk use practices, a similar public health-oriented approach to cannabis use should be considered.[5] Such an approach would rely on targeted and health-oriented interventions mainly aimed at those users at high risk for harms, and not criminalization of use – and its limited effectiveness and undesirable side-effects – as the main intervention paradigm, therefore increasing benefits for society.[2] Recent surveys consistently show that a majority of Canadians (i.e., >50%) support the decriminalization of personal cannabis use.[6]

An important educational tool in a public health-oriented alcohol policy are so-called 'Low Risk Drinking Guidelines'.[7] These use scientific evidence to provide guidelines on practices or patterns of alcohol use that substantially reduce the risks of experiencing acute and long-term harms.[7] Similarly, below we summarize data on key modifiable factors that may influence harmful outcomes from cannabis use, with a view to formulating 'Lower Risk Cannabis Use Guidelines' (LRCUG) as an evidence-based public health policy tool to reduce harms from (non-medical) cannabis use in the Canadian population.

### Early onset of use

Longitudinal studies suggest that early onset of cannabis use (e.g., <16 years) is associated with a higher likelihood of a variety of problems. For example, Lynskey followed a sample of 1,601 high school students, and found that early regular cannabis use (weekly use at age 15) increased the risk of early school leaving.[8] In a New Zealand birth cohort of 1,003 young people, cannabis use at early age was significantly associated with multiple adverse outcomes in later life, including lower rates of university degree completion.[9]

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**Acknowledgements:** The authors acknowledge research funding support from the Canadian Institute of Health Research (CIHR), the Michael Smith Foundation for Health Research (MSFHR), and the Ontario Ministry of Health and Long-Term Care for salary support for CAMH-affiliated authors. Wayne Hall is funded by an NHMRC Australia Fellowship.

**Conflict of Interest:** None to declare.

Early and regular cannabis users have been found to predict a higher risk of subsequently using other illicit drugs; i.e., the earlier in life a person initiated cannabis use, the more likely they were to become regular users of cannabis and to use other illicit substances.[10] While most cannabis users do not progress to problematic use of cannabis or other illicit substances, the overall estimated lifetime risk of developing dependence is about one in ten among ever-users and substantially higher – around one in six – among younger users.[11,12] Young users have been found – after controlling for potential confounders – to have a higher likelihood of developing subsequent mental health problems, e.g., depressive symptoms, than non-users.[13,14] Several studies also suggest that early onset of cannabis use is a strong mediating factor in the development of psychotic symptoms associated with use.[15,16]

### Frequency of use

One of the strongest predictors of cannabis use-related problems is frequency of use. Frequency of use is a common epidemiological measure and proxy for 'intensity' of cannabis use, although ideally it would be complemented by additional indicators of intake patterns, dose or potency. In most studies, 'frequent' use has been defined crudely as daily or near-daily use and compared with less intensive use. Frequent, and in particular daily use, has been found to be associated with other illicit drug use – i.e., up to an RR of >50 with confounders controlled – as well as alcohol and tobacco use.[10,17,18] Frequent users are also more likely to drive after using cannabis and to be involved in motor-vehicle accidents subsequent to cannabis use.[19] The risk of developing cannabis use dependence increases with frequency of use, and has been found to be higher among daily users (75%) compared to those using twice a week or less often (13%).[20]

Frequent cannabis users have also been found to experience impairments in cognitive, memory and learning performance.[21,22] Frequent cannabis use has been found to be a predictor of mental health problems in several studies. The associations between frequency of use and the incidence of psychotic symptoms was confirmed in large user cohort studies in Greece and Sweden[23,24] as well as in Australian and New Zealand studies.[25] The role of frequency of use was also observed by Moore et al.'s (2007) recent meta-analysis confirming the association of cannabis use and the risk of psychotic symptoms (OR 2.09; 95% CI 1.54-2.84).[26] Dose-response relationships have also been documented for cannabis use and depressive symptoms, as well as manic symptoms and suicides.[27-29] Notably, however, the studies documenting associations between cannabis use and mental health problems other than psychosis have not provided conclusive evidence on causality, or on the direction of possible causality.[15]

### Use methods, practices and substance potency

Cannabis is most commonly smoked, and many cannabis users are also tobacco users. For example, half (47%) of past-year cannabis users in the Canadian general adult population (>18 years) also reported tobacco smoking.[30] These circumstances are likely the primary cause or strongly amplify many of the problems discussed below. A systematic review demonstrated that regular cannabis smoking is associated with respiratory problems, including bronchitis, as well as wheezing, shortness of breath, chest tightness and morning sputum production.[31] The severity of most of these symptoms increased with frequency and duration of use. Cannabis smoking may be implicated in cancers of the lung or the aero-digestive tract but the epidemiological evidence on the association between cannabis use and respiratory and oral cancers is conflicting.[32] In many studies where cancers have been identified in cannabis users, these users were also tobacco smokers and/or alcohol users.[32] Given the strong evidence on both tobacco and alcohol use for cancer causation, these factors likely contributed to cancer outcomes found in the co-using populations.[10]

One particular respiratory risk of cannabis smoking arises from the practices of 'deep inhalation' or 'breath-holding', practiced in the belief that these increase the absorption of Tetrahydrocannabinol (THC), cannabis' main psychoactive agent.[33] Available data from laboratory studies suggest that such practices can increase THC absorption to some extent. This, however, comes at the cost of inhaling more hazardous by-products of smoking (including carcinogens, tar, particulate matter, carbon monoxide.[32,34] These effects are increased by the concurrent use of tobacco and cannabis.

While non-smoking methods of cannabis use (e.g., eating or drinking cannabis products) avoid respiratory risks, currently these are not common practices among users. Some studies have explored the safety of using 'vaporizers' to heat cannabis to a point where it releases active cannabinoids in vapor form without combusting and producing smoke and associated toxins. If these cannabinoid delivery systems proved to be safe and effective beyond current exploratory data, the respiratory problems related to cannabis smoking could be greatly reduced.[35,36]

Finally, in recent years – partly related to selective breeding and more advanced (e.g., hydroponic) methods of cultivation – increases in average cannabis potency have been observed.[2,37] While the greater THC content of higher-potency cannabis has been linked to more severe intoxication or psychotic symptoms, it is possible that users may titrate their dose of THC to reach a desired level of intoxication. If this is the case, then higher-potency cannabis products may reduce the harm from inhaling the toxic by-products of smoked cannabis.[37,38] In the absence of good data on the extent or health effects of dose titration, it is unknown how increased potency affects respiratory or other health risks.

### Cannabis use and driving

Cannabis use impairs cognitive, memory and psycho-motor performance in ways that may impair driving.[10] Recent data suggest that approximately 5% of Canadian drivers/adults report driving after cannabis use in the past year.[39] Large-scale epidemiological studies using different methodologies (e.g., retrospective epidemiological and case control studies) have found that cannabis use acutely increases the risk of motor vehicle accident (MVA) involvement and fatal crashes among drivers.[40,41] Recent reviews have found the increase in risk to be approximately 1.5-3.0, an increase which is substantially lower, however, than that in alcohol-impaired drivers. The impairment from concurrent alcohol and cannabis use may be multiplicative, so individuals who drive under the influence of both drugs may be at higher risk for MVAs.[42] An expert consensus view was that a THC concentration of 7-10 nanograms per millilitre in serum would produce impairment equivalent to that of 0.05% blood alcohol content (BAC). It was suggested that this level could serve as a 'per se' limit to define cannabis-impaired driving.[43] Current research suggests that acute impairment from cannabis typically clears 3-4 hours after use.[44]

This time span could be recommended to users as a minimum wait period before driving. The required wait before driving would need to be longer for higher doses, and would also vary on the basis of individual variation.

### High-risk groups

There are several groups of individuals who appear to be at higher risk of experiencing some of these negative health outcomes from cannabis use.

First, while the evidence on cannabis use effects on the female reproductive system is thin and conflicting, there is some suggestive evidence that regular cannabis use during pregnancy may lead to reduced birth weight.[45,46] These possible consequences of cannabis use have not been reliably separated from the well-established severe negative effects from alcohol or tobacco use during pregnancy as potential confounders,[45,47] though prudence would suggest avoiding use of cannabis, alcohol and tobacco during pregnancy.

Second, the cardiovascular stimulatory effects of cannabis use may put older adults with hypertension, ischaemic or cerebrovascular disease at risk of acute cardiovascular problems, including myocardial infarction. In a case-crossover study, the risk of myocardial infarction was found to be 4.8 times higher in the hour after cannabis use, and it was estimated that middle-aged users increase their annual absolute risk of a cardiovascular event by 1.5%-3%.[48]

Third, psychotic symptoms appear much more likely (i.e., RR of 1.5 or higher) to occur in cannabis users with either an affected first-degree relative (parent or sibling) or a personal history of psychotic symptoms.[49,50]

## DISCUSSION AND RECOMMENDATIONS

On currently available evidence, problems from cannabis use increase with increasing frequency, duration or amounts (i.e., intensity) of use, yet the shape of the risk curve cannot be well specified on the basis of currently existing data. There appear to be several modifiable behavioural factors which increase acute and/or long-term adverse health outcomes of cannabis use. Hence, we conclude that risk for several pre-eminent health harms, and overall burden of disease, associated with cannabis use could be reduced markedly in Canada if (non-medical) users adhered to the following recommendations:

1) The simplest way of avoiding any risks from cannabis use is to abstain from use, but for those who use cannabis it is important to recognize that risks may be affected by patterns of use and individual circumstances.
2) The risks of dependence and other key problems related to use is higher for those who initiate use early, so it would be desirable to delay use until late adolescence (e.g., 16+ years) or better yet early adulthood (e.g., 18+ years).
3) Frequent use (i.e., daily or near-daily use) is associated with most severe problems and should be avoided.
4) Frequent users who experience difficulty controlling their use should attempt to cease use; if they are unable to do so unaided, they should seek professional help.
5) In order to reduce respiratory, bronchial and cancer risks, users who insist on cannabis smoking should (in this priority order): avoid smoking cannabis with tobacco; avoid deep inhalation or breath-holding; and use vaporizers rather than smoking joints, blunts or water pipes.
6) Use of higher-potency cannabis products may lead to more intense impairment or even acute problems like psychotic symptoms, unless users titrate the THC dose, in which case the chronic health risks from inhaling toxic by-products may be reduced. Users should exercise caution with regard to the cannabis substance consumed, especially when using an unfamiliar cannabis product, and learn to limit their intake to the minimum amount needed to achieve the desired psychoactive effects.
7) Given the evidence of acute cannabis impairment on MVA risk (and the absence of clearly definable 'low risk' levels of use), users should not drive for conservatively 3-4 hours after use, or longer if larger doses are used or the effects of acute impairment persist.
8) The possibility of cannabis use-related problems is elevated in the following groups: pregnant women; middle-aged or older men with cardiovascular problems; and individuals with a history of psychosis, or a first-degree relative with a history of psychosis. These groups should consider entirely abstaining from use.

These recommendations are generally in accord with similar suggestions made elsewhere.[2,33]

## LIMITATIONS AND CONCLUSIONS

The above LRCUG are based on peer-reviewed reviews of the epidemiological and other evidence on adverse health effects of cannabis. Our task is more complicated than the formulation of analogous advice on less risky alcohol use because the health effects of cannabis are not as well studied nor understood. For example, the studies on the health effects of cannabis use have used cruder measures of cannabis use (e.g., with consequent uncertainties about dose) and there are scientific debates about whether commonly reported associations are causal or attributable to uncontrolled residual confounding. Even when these relationships are causal (as in the case of cannabis dependence), there is much poorer specification of dose-response relationships between cannabis use and the risk of these adverse outcomes than is true for alcohol. In the face of these limitations, we have developed the advice to users by assuming that relationships are causal when the evidence supports the conclusion that this is more likely to be true than not, rather than requiring that the evidence demonstrate causal relationships beyond reasonable doubt, e.g., as in the case of the associations between regular and early cannabis use and psychotic symptoms.

It is also appropriate to note here that the above recommendations primarily focus on health risks related to cannabis use. Cannabis' current legal status as a criminally prohibited drug in Canada means that users risk arrest and criminal conviction, the effects of which can be seriously detrimental for young people, who are the predominant users of cannabis.[2]

In summary, we are confident that the above LRCUG constitute a valuable intervention tool to facilitate a more public health-oriented and evidence-based cannabis use policy in Canada.

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Received: March 10, 2011
Accepted: April 21, 2011

## RÉSUMÉ

**Objectifs :** Plus d'un adulte sur dix – et environ un jeune adulte sur trois – déclare avoir consommé du cannabis au cours de la dernière année au Canada. La consommation de cannabis est associée à divers risques pour la santé, mais contrairement aux politiques sur l'alcool, la politique actuelle sur le cannabis interdit toute consommation plutôt que d'adopter une approche de santé publique avec des interventions faites pour aborder les risques et les méfaits particuliers de cette drogue. Nous avons voulu élaborer des « directives de consommation à moindre risque pour le cannabis » (DCMRC) à la lumière des données de recherche sur les effets défavorables du cannabis pour la santé et sur les facteurs qui semblent atténuer le risque de ces méfaits.

**Méthode :** Nous avons examiné des publications à comité de lecture, de langue anglaise, portant sur les méfaits pour la santé de la consommation du cannabis, et rédigé des DCMRC selon un processus consensuel.

**Synthèse :** Notre examen a montré que les méfaits du cannabis pour la santé augmentent avec l'intensité de la consommation, mais que la courbe du risque n'est pas bien définie. Les méfaits du cannabis sont associés à des facteurs potentiellement modifiables liés à : la fréquence de consommation; le début précoce de la consommation; la conduite automobile après la consommation; les méthodes et les pratiques de consommation et la teneur de la substance; et les caractéristiques de certaines populations. Nous présentons nos DCMRC, qui recommandent des moyens de réduire les risques de la consommation de cannabis à l'échelle individuelle et populationnelle – un peu comme les « directives de consommation à faible risque » pour l'alcool.

**Conclusion :** Étant donné la prévalence et la structure par âge de la consommation de cannabis au Canada, une politique publique sur le cannabis conçue sous l'angle de la santé publique se fait attendre depuis longtemps. Nos DCMRC pourraient être un précieux outil pour faciliter la réduction des méfaits pour la santé de la consommation de cannabis à l'échelle de la population.

**Mots clés :** Canada; cannabis; épidémiologie; morbidité; politique; santé publique