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Closing the Gaps

Cannabis Research Summary Report

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Table of Contents

Executive Summary	1
Introduction.....	2
The Impacts of Legalization.....	3
Medical Use Versus Nonmedical Use	5
Cannabis and Mental Health	6
Cannabis and Physical Health	8
Purchase Decisions.....	9
Modalities of Use	11
Polysubstance Use	13
Stigma and Responsible Cannabis Use.....	14
Voices of First Nations, Métis and Black People	16
Next Steps and Further Research Questions	18
References	20
Appendix	21



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Land Acknowledgement

We respectfully acknowledge that the offices of CCSA are located on the traditional, unceded and unsurrendered territory of the Algonquin Anishinaabe people, who have been present on this land and its stewards since time immemorial. As a national organization, we also acknowledge that we work on the traditional lands of many distinct nations, including Métis (settlements) and Inuit (Inuit Nunangat, homeland). We are humbled to have the opportunity to be present on these territories.

We pay our respects to and honour all First Nations, Métis and Inuit as distinct Peoples and as sovereign Traditional Knowledge keepers. We are humbled to have the opportunity to be present in these territories.

In the spirit of reconciliation with First Nations, Métis and Inuit Peoples in Canada, CCSA is committed to contributing to making positive changes in our relationship with Indigenous Peoples and to honour the Truth and Reconciliation Commission of Canada's Calls to Action and the United Nations Declaration on the Rights of Indigenous Peoples.

Conflict of Interest

There are no conflicts of interest to declare.



Executive Summary

In 2018, Canada became the second country in the world, and the first of the G20 nations, to legalize recreational cannabis. As part of the legalization, a legislative review was planned to assess the impacts of legalization on individuals and society. The *Closing the Gaps* research program was launched to investigate some of the key questions the Government of Canada had about legalized cannabis and its effects on people across Canada.

With funding support from Health Canada and the Mental Health Commission of Canada, the Canadian Centre on Substance Use and Addiction funded 19 research projects to look at the physical and mental health effects of cannabis in a legalized context, how people were using cannabis and how it was affecting them, where people choose to buy their cannabis products and what factors affect those decisions, and more. This report provides federal, provincial and territorial policy makers with a summary of some of the key findings of the *Closing the Gaps* studies, specifically in the areas of legalization impact, medical use versus nonmedical use, mental and physical health, purchase decisions, modalities of use, polysubstance use and stigma. The report also recommends areas for further study.

Key Findings

- Legalization of cannabis has not been shown to have a significant impact on cannabis or other substance use among individuals with substance use disorder, but it is too soon to evaluate the long-term impacts of legalization.
- Evidence on the potential benefits and harms of cannabis use is still in its early stages. More research is needed to develop appropriate guidance for lower-risk use.
- Early evidence shows potentially higher physical risks for females using cannabis. There is also potential for adverse interactions between cannabis and other drugs. More evidence is needed to address both these risks.
- Many individuals who use cannabis are shifting to legal markets. Reducing the price differential between legal and illegal markets, prioritizing the customer experience and adjusting product offerings may help accelerate this shift.
- Despite the potential respiratory harms of smoking cannabis, this method remains prevalent, primarily because of convenience and cost effectiveness. New strategies may be needed to shift use to less harmful modalities.
- There is increasing evidence that co-use of alcohol and cannabis increases associated risks. Policies are needed to discourage the co-location of alcohol and cannabis sales.
- Stigma related to cannabis use remains an issue that may itself be contributing to certain harms. More must be done to reduce stigma, particularly among marginalized populations.

Next Steps

While the research funded through this initiative offers valuable new information, it is important to acknowledge that we are still in the early days of legalization. Market expansion, attitudes and other factors will likely shift over time, contributing to long-term effects on individual and public health that cannot be fully assessed at this time. For this reason, research of this kind must continue, both to monitor trends and long-term impacts and to answer additional questions that could not be fully explored within the context of this research program.



Introduction

In 2018, Canada legalized the production, sale and use of nonmedical cannabis. As part of the legalization, a legislative review of the *Cannabis Act* was mandated by Health Canada to assess the impacts of legalization on individuals and society. The Canadian Centre on Substance Use and Addiction (CCSA) launched *Closing the Gaps* to investigate some of the key questions the Government of Canada had raised about legalized cannabis and its impact. This CCSA research program looks at specific populations, health outcomes and legal markets across the country.

The Cannabis Act, 2018

The *Cannabis Act* provides a legal and regulatory framework to control the production, distribution, sale and possession of cannabis in Canada. The act is intended to promote public health by restricting youth access, establishing quality and safety standards, and enhancing public awareness of the health risks associated with cannabis use.

Closing the Gaps Research Initiative

In late 2020, CCSA issued a request for proposals to gather knowledge in under-researched areas to support the assessment of the impact and effectiveness of cannabis policies, regulations and programs. With funding support from Health Canada, as well as a contribution from the Mental Health Commission of Canada, CCSA invested \$1.8 million in 19 research projects that were selected following an independent and rigorous peer-reviewed scoring process by a review panel established by CCSA. Through this *Closing the Gaps* initiative, the projects address gaps in research on the impact of cannabis legalization on mental health, illegal versus legal cannabis markets and consumer preferences, as well as on the effectiveness of cannabis policies, regulations and programs. They also include research on specific populations such as First Nations and Métis people, veterans, and pregnant and breastfeeding/chestfeeding parents. All studies were launched in November 2020 and were completed in March 2022.

This report provides federal, provincial and territorial policy makers with a summary of some of the key findings of the *Closing the Gaps* studies, specifically in the areas of legalization impact, medical use versus nonmedical use, mental and physical health, purchase decisions, modalities of use, polysubstance use and stigma. It does not address research outside this initiative. This report also summarizes existing knowledge gaps and areas for future research to explore (see Next Steps and Further Research Questions). While the majority of these projects are complete in terms of data collection, many of the researchers are continuing to expand on their initial findings, develop knowledge dissemination products and publish their work. To learn more about each study and any resulting publications, please see the Appendix. This report is intended primarily for policy makers, government representatives and researchers working within the cannabis field.

Much of the research took place during the COVID-19 pandemic and its associated public health restrictions, which affected how some of the studies were conducted. This may have had an impact on some results (e.g., research ethics approval delays, study participant enrolment challenges). In addition, cannabis legalization is still very recent. It is too early to understand its full and long-term impact on public health and safety, and continued research and monitoring are required. Therefore, all findings should be interpreted within these contexts.



The Impacts of Legalization

To better understand how the legalization of nonmedical cannabis use affected populations across Canada, CCSA-funded studies led by Dr. Jean Costello, Dr. Hai Nguyen, and Dr. Philip Tibbo looked at what changed when nonmedical cannabis was legalized.

Among Youth Aged 15–18 Years and Adults with Substance Use Disorder, Legalization Does Not Appear to Have Significantly Increased Cannabis Use Prevalence

In the study led by Costello, the prevalence of cannabis use among individuals experiencing substance use disorder (SUD), including cannabis use disorder (CUD), did not change from April 2017 (pre-legalization) to February 2020 (post-legalization). This applies to both males and females, although the prevalence of cannabis use among males increased over time (2017–2020). Similar results were found for tobacco, alcohol and other drug use, with cannabis legalization resulting in minimal change in the prevalence of other substance use. This could be due to the already high rates of substance use reported in this population (67% of participants reported use of alcohol, 16.8% reported use of stimulants, 13.7% reported use of sedatives).

The study led by Nguyen found that the number of youth aged 15–18 years who started consuming cannabis (after having never tried cannabis) increased by 69% after legalization. However, the study observed no change in the overall prevalence of cannabis use in this age group over the same period. This suggests that some youth who were already using cannabis likely stopped, counterbalancing the increased number of youth using it for the first time. Additionally, while youth reported that legalization made cannabis easier to access, the researchers also found that legalization appeared to be associated with greater perception and awareness of cannabis-related harm among youth.

Age Restrictions Appear to Reduce Cannabis Use in Youth Who Are Nearing the Minimum Legal Age

Given that one of the stated goals of the *Cannabis Act* was to prevent youth from accessing cannabis, a key question was how legalization would affect cannabis use among youth. While availability of legal cannabis could encourage youth who have never used cannabis to try it for the first time, purchase restrictions through minimum legal age laws could also persuade existing underage consumers to stop using cannabis. At the time of legalization, most provinces and territories set the legal minimum age at 18 or 19 years. In January 2020, Quebec raised its legal minimum age to 21 years from 18. Nguyen's study found that while cannabis use among youth increased in all provinces the following year, the increase among youth aged 18–20 years was lower in Quebec relative to other provinces. Among youth aged 15–17 years, there was no significant difference in cannabis use rates in Quebec versus the control provinces. These findings may help alleviate the concern that a higher minimum legal age for cannabis could draw youth back to illegal markets.

More People in Some Regions Visited the Emergency Department for Cannabis-Related Reasons Since Legalization

The study led by Tibbo looked at emergency department visits from a sample of hospitals in Nova Scotia. The study found that the number of cannabis-related emergency department visits for both mental and physical health concerns has increased since legalization. However, the study did



not investigate the number of non-cannabis-related visits, so no conclusions can be drawn about whether this increase is in line with the number of emergency department visits overall. Among the cannabis-related presentations, 57% involved physical health, with the remaining cases involving mental health. The sex breakdown was 57% male, 41% female and 2% unspecified.

The most common physical presentation was chest pain, followed by nausea or vomiting. Chest pain was more common among males (66%), while 57% of the vomiting presentations were among females.

Depression and suicidal ideation were the most reported mental health concerns of patients. Of those who presented to the emergency department with this concern, 53% were male, 46% were female and 1% were transgender or nonbinary. Slightly more than half of this group had a pre-existing diagnosed mood disorder.

Of particular concern to the study authors is the small number of patients (10) across a wide age range who presented with homicidal or violent behaviour, including two patients with no history of diagnosed mental illness. Despite this group all having referrals to outpatient mental health services, only half attended their referral appointments, pointing to a greater need for improved public health education and engaging patient services.

In nearly two-thirds of the overall mental health cases, patients were also taking psychiatric medications, and some symptoms may have been caused or exacerbated by the metabolism-slowing effect of cannabis or other drug interactions. Greater awareness is needed around the possibility and outcomes of such drug interactions with cannabis use.

Key Findings and Policy Implications

- Legalization has not been shown to have a significant impact on cannabis or other substance use among individuals with substance use disorder directly following legalization; it is possible immediate changes in this population are not apparent due to already high rates of substance use.
- Given the increased rates of cannabis-related emergency department visits, there are opportunities to improve public health education and patient services.
- A minimum legal age may reduce cannabis use among those who are nearing the minimum age, but it has not been shown to have any noticeable effect on those several years younger than the minimum age.
- It may be too soon to evaluate the longer-term impact of legalization on substance use disorder given the time it takes for cannabis use disorder symptoms to emerge and for those individuals to report or seek treatment.
- More recognition is needed in emergency departments of the potential impact of cannabis on other health presentations.

Studies referenced in this section (see the Appendix for more details on each):

- Costello, J., & MacKillop, J. Changes in substance use and mental health in two hospital-based addiction treatment programs over the course of recreational cannabis legalization in Canada.
- Nguyen, H., Mital, S., Grootendorst, P., & Bornstein, S. Impacts of Canada's recreational cannabis legalization on youth cannabis use and medical cannabis consumption.



- Tibbo, P. Understanding cannabis-related physical and mental health presentations to the emergency department following legalization of nonmedical cannabis use.

Medical Use Versus Nonmedical Use

For a clearer picture of how attitudes toward medical use of cannabis changed since the legalization of nonmedical cannabis use, studies led by Dr. Stefan Kloiber, Dr. Lindsay Farrell and Dr. Zach Walsh, Dr. Benicio Frey, and Dr. Hai Nguyen looked at what people report using cannabis for and how legalization has affected medical use.

The Distinction Between Medical and Nonmedical Cannabis Use Is Unclear

The study led by Kloiber found that nearly half of their study participants, which consisted of individuals with mental health conditions (mood disorders, anxiety disorders, posttraumatic stress disorder, obsessive-compulsive disorder), reported using cannabis for both medical and nonmedical purposes. Despite more than 60% of participants reporting cannabis use for medical reasons, only 20% reported this being recommended, prescribed or both, and only a small number (14.6%) obtained information about cannabis consumption from a medical practitioner.

An additional risk identified was that the majority (53.1%) of individuals obtained products from unregulated sources. This creates a problematic overlap of using a substance for treatment versus recreation, where a perceived effect of cannabis (e.g., to relieve symptoms of depression and anxiety) may be outweighed or negated by the potential harm (e.g., using unregulated cannabis products, harmful consumption methods).

In contrast to Kloiber's study, a large proportion of respondents from First Nations communities reported discussing their medical cannabis consumption with their physicians in Farrell and Walsh's study. Despite legalization of cannabis and growing acceptance of medical cannabis use across these communities, respondents still identified existing stigma associated with cannabis use.

The observed increase in the medical motives among cannabis consumers suggests a need for further research to help refine strategies to accentuate benefit and mitigate risk. These studies are an important first step in exploring this work.

Cannabis Is Being Used to Manage a Wide Range of Symptoms

Previous research has found that many people use cannabis as a substitute for other prescription drugs (Katzman, 2014). Studies led by Frey and by Farrell and Walsh found that pain management, mental health and sleep aid concerns are among the top therapeutic reasons cited for cannabis use. However, based on self-reported data of cannabis consumers, the team led by Frey observed that many have found that cannabis does improve their symptoms. For both pain and mental health conditions, Frey found females aged 25–34 years were most likely to report using cannabis to manage their symptoms. The study also found that despite recommendations against youth cannabis use, 17% of youth are turning to cannabis to help them manage similar symptoms as adults.

Medical Cannabis Use Has Decreased Since Legalization

The study led by Nguyen using a cross-section of Canadian surveys observed that before the legalization of nonmedical cannabis the use of medical cannabis was increasing consistently over time. Nguyen's team found that after legalization, medical cannabis use declined by 48% across the



country. However, the team found that these reductions varied considerably among provinces – from 32% in Newfoundland and Labrador to 74% in Alberta.

Upon further investigation, the team found that decreases in medical cannabis use were correlated with the availability of illegal dispensaries and with lower prices for nonmedical cannabis. Decreases in medical cannabis use were also strongly associated with provinces that had looser restrictions on medical cannabis use and eligibility. This suggests some people whose cannabis use was previously classified as medical may now be getting their cannabis from the nonmedical or illegal markets. This has the potential for health risk, as nonmedical cannabis is often associated with higher or inconsistent THC content, and its use is not overseen by a healthcare practitioner. Illegal cannabis is also not subject to rigorous quality controls as cannabis from licensed producers.

Key Findings and Policy Implications

- The challenge of clearly distinguishing between medical and nonmedical cannabis use makes it difficult for policies to address only one type of use at a time.
- Legalization has resulted in shifts in both perception of use and use of cannabis across sex and age; individuals self-identifying as female aged 25–34 years consumed cannabis most often to manage their symptoms.
- The prevalence of cannabis use for pain and mental health symptom management despite a lack of endorsement from the medical community suggests an urgent need to improve understanding of the efficacy of cannabis for these purposes by both the medical community and cannabis consumers themselves. With that understanding, appropriate guidance may be developed that better meets the needs of people in Canada who use cannabis.

Studies referenced in this section (see the Appendix for more details on each):

- Farrell, L., & Walsh, Z. Cannabis use among First Nations Peoples of Turtle Island: Motives of use, substitution and impacts of legalization.
- Frey, B., Minuzzi, L., MacKillop, J., Ballester, P., & Kuhathasan, N. A gender- and age-based analysis of cannabis use for pain and mental health in a large Canadian naturalistic sample.
- Kloiber, S. Understanding cannabis use and perceptions in patients with mood and anxiety disorders.
- Nguyen, H., Mital, S., Grootendorst, P., & Bornstein, S. Impacts of Canada’s recreational cannabis legalization on youth cannabis use and medical cannabis consumption.

Cannabis and Mental Health

To learn more about the potential effects of legalization on mental health, CCSA-funded studies led by Dr. Stefan Kloiber, Dr. Alasdair Barr, and Dr. Jean Costello looked at mental health outcomes among people who use cannabis.

The Evidence on the Mental Health Risks and Benefits of Cannabis Remains Inconclusive

Based on the results of their study, Kloiber and his team suggest that the medical cannabis program, followed by the legalization of nonmedical cannabis, may have contributed to the perception that



cannabis is an effective treatment for mental health conditions, despite limited evidence and potential harmful effects.

The study led by Barr found that people under the age of 30 years were most likely to report using cannabis for depression, and those under the age of 25 years reported the highest use for sleep issues. However, Barr's team did not find evidence that cannabis use increased self-reported adverse mental health outcomes among young people. The team observed that the age of first use tended to be earlier among those who met the criteria for problematic cannabis use. Costello's research found that problematic use or symptoms of CUD were also associated with depression, anxiety and posttraumatic stress disorder (PTSD) in all age groups within the study samples.

Kloiber's team found that those who consume cannabis for depression and PTSD often self-report symptom improvement, and many cite adverse experiences with prescribed medications as a reason for choosing cannabis to mitigate their symptoms. Cannabis consumers in the study perceived a 58% to 99% reduction in stress and anxiety symptoms. However, the study also included reports of negative effects, including reduced cognition, energy and motivation. Some anxiety disorders may also be associated with greater rates of cannabis dependence, often because of emotional regulation difficulties that may lead to cannabis use as a coping mechanism.

Cannabis use may be especially problematic for people with social anxiety disorder. In their systematic review, Kloiber's team found studies reporting a correlation of social anxiety disorder with cannabis dependence with more than twice the rate of dependence as found for other anxiety disorders. Costello's research also reinforced the complex relationship between cannabis use and psychiatric comorbidities, finding that elevated CUD symptoms were associated with more severe symptoms of PTSD, anxiety and depression.

Barr's team also found that the risks of adverse mental health outcomes appear to be higher for those who are "self-treating" rather than taking cannabis under medical guidance.

Key Findings and Policy Implications

- The relationship between cannabis use, particularly cannabis use disorder, and the severity of symptoms of depression, anxiety and PTSD is complex, and future policy directions should consider their impacts on mental health and other comorbidities.
- Evidence on the reported benefits and potential harms of cannabis use continues to be contradictory within these studies and across the literature. There are many factors to consider, including population, pre-existing medical or mental conditions, and mode of use.
- More information on using cannabis safely should be made accessible, and people should be strongly encouraged to seek the guidance of healthcare providers about cannabis use.

Studies referenced in this section (see the Appendix for more details on each):

- Barr, A., & Panenka, W. Understanding the relationship between recreational cannabis use and mental health in a marginalized population.
- Costello, J., & MacKillop, J. Changes in substance use and mental health in two hospital-based addiction treatment programs over the course of recreational cannabis legalization in Canada.
- Kloiber, S. Understanding cannabis use and perceptions in patients with mood and anxiety disorders.



Cannabis and Physical Health

As the research around potential physical health effects of cannabis use continues to advance, studies led by, Dr. Kara Thompson, Dr. Saara Greene, and Dr. Philip Tibbo investigate more specifically some of the physical risks, benefits and other effects of cannabis use.

The Risks and Harms of Cannabis Use Appear to Vary by Sex and by How Cannabis Is Consumed

In the study led by Thompson, the physiological risks of cannabis use were found to be higher for females than for males, despite the finding that males tend to consume stronger products in higher quantities. Young females in the sample had particularly low VO₂ max scores (a cardiovascular fitness indicator), ranging in only the 30th percentile for females aged 18–24 years. Co-use with alcohol and strength of cannabis products were both associated with significant increases in heart rate for females but not males. Findings suggest that females might be particularly vulnerable to the cardiovascular risks associated with regular and heavy use of cannabis.

Among both males and females, Thompson’s team observed an association between high-strength products and greater risk of adverse physiological effects, including dizziness, fatigue, headaches, stomach aches, coughing and cognitive effects. These effects are also associated with co-use of alcohol. The use of bongs and vaporizers is also associated with greater risk of physical effects, including experiences of fatigue, coughing, dizziness, headaches and stomach aches, particularly among males.

There Is an Urgent Need for More Evidence on Cannabis and Pregnancy

In a qualitative study led by Greene using photovoice workshops and individual interviews with 23 participants, it was observed that there are still significant gaps in the evidence on the risks and benefits of cannabis use during pregnancy. In the absence of conclusive evidence, medical guidelines recommend against it. What little evidence exists is generally derived from research focused on public health that rarely considers the actual and perceived experiences of pregnant people or their quality of life. Greene’s team found that pregnant and breastfeeding/chestfeeding people who choose to use cannabis are often looking for help to calm down or relieve anxiety, or to feel more connected with their bodies — especially those with a history of trauma.

Although many of the study participants had questions about cannabis use during pregnancy or breastfeeding/chestfeeding, most were extremely hesitant to discuss it with their doctors, doulas or midwives for fear of judgment and reprisal. Instead, many turned to online searches, but little information is available there either, and much of it is inaccurate, misleading and not credible. As a result, they are left to navigate the issue on their own, leaving them at higher risk of adverse outcomes.

The Interactions Between Cannabis and Other Drugs Are Not Well Understood

In the study led by Tibbo on cannabis-related emergency department visits, one observation was that many patients were also taking other medications, including psychiatric medications. Given that some cannabinoids are known to alter metabolism and drug clearance rates,¹ it is likely that some of the physical and mental presentations may have been caused or exacerbated by drug–drug

¹ This refers to the rate of drug elimination in the body, that is, how long it takes for a substance to be cleared from all tissues in the body.



interactions. More research is needed to better understand these interactions, provide guidance on avoiding them and treat them appropriately.

Key Findings and Policy Implications

- Public health messaging around cannabis use should acknowledge the differences between sexes and emphasize the potential higher risks to females.
- Policies that regulate the availability of high-strength products and prohibit bulk purchasing could be important harm reduction tools.
- In addition to more research, strategies such as physician-patient communication, public health resources and awareness campaigns are also needed to ensure pregnant and breastfeeding/chestfeeding people can safely disclose their cannabis use without reprisal so they can mitigate risks with appropriate medical guidance.
- Public health messaging should underscore the potential for adverse interactions between cannabis and other drugs, and there should be more research in this area to refine appropriate guidance.

Studies referenced in this section (see the Appendix for more details on each):

- Greene, S. Wading through the weeds: A public health response to pregnant and breast/chestfeeding people who consume cannabis.
- Thompson, K., Watt, M., Goldstein, A., & Asbridge, M. An examination of the sex-specific psychophysiological markers of risk for physical and mental health problems across modes of cannabis use.
- Tibbo, P. Understanding cannabis-related physical and mental health presentations to the emergency department following legalization of nonmedical cannabis use.

Purchase Decisions

To understand how the legalization of nonmedical cannabis use affected people's purchasing decisions, CCSA-funded studies led by Dr. Elle Wadsworth and David Hammond; Dr. Stefan Kloiber; Dr. Lindsay Farrell and Dr. Zach Walsh; Dr. Jennifer Donnan; Dr. Samantha Goodman; and Dr. Didier Jutras-Aswad examined the effects of pricing, packaging and other factors.

The Percentage of People Buying Cannabis from Legal Sources Is on the Rise

In the study led by Wadsworth and Hammond, the percentage of all consumer groups purchasing legally was found to have increased between 2019 and 2021. Wadsworth and Hammond's team also found that the higher prices of legal sources of cannabis were the most cited reason for continuing to purchase from unlicensed sources, and they theorize that the narrowing price differential may be contributing to the overall shift toward legal sources. This said, Kloiber found that a large percentage of cannabis consumers in their study continued to obtain their products from illegal sources (e.g., dealers or unlicensed dispensaries) rather than from legal sources.



Price Is the Primary Determinant Factor Affecting People’s Cannabis Purchase Decisions

As noted, price is the most reported barrier to switching from unlicensed to licensed sources of cannabis, especially for frequent consumers. Studies led by Wadsworth and Hammond, by Farrell and Walsh, and by Donnan have found cost to be one of the primary considerations for nearly all cannabis purchasers. Donnan’s team found that quality is another key determinant, but there is little agreement among cannabis consumers as to what “quality” means. Some rate quality based on cannabis regulation standards, others on its ability to achieve the desired effect. The most knowledgeable consumers rate cannabis according to a wide range of specific characteristics. And while some of those who continue to purchase from unlicensed sources do so because they perceive the quality to be higher, Kloiber’s team found that around three-quarters of those who purchase from unlicensed sources express concern about the possibility of the product being laced with other substances. Some participants in the study led by Farrell and Walsh also indicated they felt safer purchasing from legal sources.

Donnan’s team found that for some cannabis consumers, particularly relatively new consumers, the customer experience can also affect their decisions about where to buy. Certain types of cannabis stores that do not operate under a typical cannabis retail model (such as those set up inside other retailers) are restricted from offering any information (outside of what is on the package) or recommendations, as they operate in environments where minors can be present. Additionally, it has been noted that employees in these atypical retail stores are not always hired based on their knowledge or experience with cannabis, and sometimes they hold stigmatizing views toward the customers. Donnan’s team observed that most purchasers seem to want a friendly, welcoming experience and to be served by knowledgeable sellers who can make recommendations based on their needs.

The Impact of Packaging on Purchase Decisions Is Unclear

In the study led by Goodman, many participants expressed indifference to the look of cannabis packaging; however, other measures suggested that branded packages may be more appealing than plain ones. Additionally, Goodman’s team observed that the branding used (including elements such as colours, symbols and imagery) can convey lifestyle associations that may shape and influence a respondent’s potential interest in using cannabis products. Health warning labels also appear to contribute to people’s opinions of the products: study respondents perceived packages without warnings as less safe and of lower quality.

The study led by Jutras-Aswad found that people who buy their cannabis from legal sources appeared to be more aware of the cannabinoid content of their cannabis. Goodman’s team also found that recall of specific warning messages appears to be highest in jurisdictions that require warning labels on cannabis packaging, suggesting that package labels may be an effective way to communicate health risks. However, there is room for refinement of the specific messaging and the language used to ensure messages are being received and understood adequately. Goodman’s team found that labels intended to convey THC and CBD content were unclear to many participants, who found the current labelling conventions confusing.

Many participants in Donnan’s study expressed frustration with cannabis packaging itself, which is generally designed to be childproof. Participants found such packaging overly complex and difficult to open, and many were especially concerned with the waste associated with excessive, nonrecyclable packaging.



Key Findings and Policy Implications

- Reducing the price differential between the legal and illegal markets, prioritizing the customer experience and adjusting product offerings may help encourage people to purchase cannabis from legal sources.
- Awareness of specific warning messages is highest in jurisdictions that require warnings on packages, suggesting that warning labels may improve knowledge of cannabis-related health risks.
- Research on the impact of packaging and labelling of cannabis products is still in its early stages, but early evidence suggests that labels require further refinement of the language level, its relatability to target populations, distinct forms of language use and strategies to improve general cannabis literacy across the population.
- More environmentally conscious packaging options should be explored.

Studies referenced in this section (see the Appendix for more details on each):

- Donnan, J., Bishop, L., Najafizada, N., & Johnston, K. A choice modelling study to explore Canadian consumer preferences for attributes of cannabis products and purchase experiences.
- Farrell, L., & Walsh, Z. Cannabis use among First Nations Peoples of Turtle Island: Motives of use, substitution and impacts of legalization.
- Goodman, S., Leos-Toro, C., & Hammond, D. Evaluating the impact of legalization of nonmedical cannabis in Canada: Health warnings and understanding of the health risks associated with cannabis use.
- Jutras-Aswad, D., Conus, F., Kaur, N., & Larney, S. Public health outcomes of cannabis supply sources: Examining the evidence among Quebec cannabis consumers.
- Kloiber, S. Understanding cannabis use and perceptions in patients with mood and anxiety disorders.
- Wadsworth, E., & Hammond, D. Transitioning to the legal cannabis market in Canada: Legal and illegal cannabis purchases, and the effect of price, retail availability, and consumer perceptions.

Modalities of Use

The potential risks of cannabis use differ depending on how cannabis is consumed. Studies led by Dr. Stefan Kloiber, Dr. Lindsay Farrell and Dr. Zach Walsh, Dr. Alasdair Barr, Dr. Kara Thompson, Dr. Benicio Frey, Dr. Igor Yakovenko, and Dr. Jennifer Donnan, investigated the most common methods of cannabis use and the understanding of associated harms within certain groups.

Most Cannabis Consumers Choose Inhalation-Based Methods of Use

Several of the *Closing the Gaps* studies found that most cannabis consumers use inhalation-based methods, rather than edible or topical options. More than half choose to smoke cannabis, according to Kloiber's study. The rate was even higher in Farrell and Walsh's study, where 90% of participants reported smoking as a primary modality. Barr's team found that 47% of participants across all demographics preferred smoking. The team also found that 63.8% of frequent consumers chose



smoking as the preferred consumption mode. Barr's study also looked at patterns of use and observed no significant differences across three different age groups (19–24, 25–30 and 31–40 years). By contrast, Thompson's study found that bong use was highly prevalent among young adults (68% of males and 63% of females preferred bongs). Participants cited convenience, cost effectiveness and a more intense high as the reasons for choosing bongs as a mode of consumption.

Additionally, Barr's team found that people who choose inhalation-based methods of use, especially those who smoke cannabis, tend to prefer THC-dominant cannabis products, while those who choose non-inhalation-based methods tend to prefer CBD-dominant products.

Among those who use cannabis for therapeutic reasons, Frey's team found that vaping was the most common choice for pain relief among both males (44% of occasions) and females (41.5% of occasions). For treating mental health symptoms, they found that females were more likely to choose vaping (34% of occasions), while males preferred smoking (40% of occasions). These observations held for most demographics, except for those aged 45–54 years, who chose oil for pain management (41% of occasions).

More Research and Messaging Are Needed on the Harms of Vaping

In the study led by Yakovenko, adults aged 18–30 years who vape cannabis regularly demonstrated incomplete knowledge and understanding of what vaping is and how it works, and a low awareness of associated risks. Yakovenko's team observed that poor knowledge about vaping also appears to be associated with higher use of cannabis and a greater risk of problematic cannabis use.

Additionally, he found that young adults who vape regularly tend to engage in riskier cannabis use, generally not following most of the lower-risk cannabis use guidelines.

Because of concerns about the potential harms associated with vaping cannabis, some jurisdictions do not allow the sale of vaping products. However, many people who use cannabis still choose vaping. Without access to licensed products, they may continue to purchase from unlicensed suppliers, which could increase their risk of harm. Given this situation, Donnan suggests there could be value in a fuller exploration to determine the relative risks and benefits to public health of restricting access to vaping products. This exploration would be particularly valuable in the face of emerging evidence that much of the harm may be related to vitamin E acetate (Boudi et al., 2019), which is already prohibited in licensed vape liquids in Canada.

Key Findings and Policy Implications

- Although public health messaging already encourages the use of non-combustible forms of cannabis, new strategies may be needed to overcome the cost effectiveness and convenience of inhalation-based cannabis, particularly among young people who are often especially price sensitive.
- Emerging adults in Canada who vape cannabis regularly are observed to disregard *Canada's Lower-Risk Cannabis Use Guidelines* and are not fully knowledgeable about the impacts of vaping.
- There remains conflicting research on the different modes and patterns of cannabis use associated with different age, sex, and gender groups. This data serves as a starting point to better evaluate differences in use and corresponding risk factors as well as create practical harm reduction strategies.



Studies referenced in this section (see the Appendix for more details on each):

- Barr, A. & Panenka, W. Understanding the relationship between recreational cannabis use and mental health in a marginalized population.
- Donnan, J., Bishop, L., Najafizada, N., Johnston, K. A choice modelling study to explore Canadian consumer preferences for attributes of cannabis products and purchase experiences.
- Farrell, L., Walsh, Z. Cannabis use among First Nations Peoples of Turtle Island: Motives of use, substitution and impacts of legalization.
- Frey, B., Minuzzi, L., MacKillop, J., Ballester, P., Kuhathasan, N. A gender- and age-based analysis of cannabis use for pain and mental health in a large Canadian naturalistic sample.
- Kloiber, S. Understanding cannabis use and perceptions in patients with mood and anxiety disorders.
- Thompson, K., Watt, M., Goldstein, A., Asbridge, M. An examination of the sex-specific psychophysiological markers of risk for physical and mental health problems across modes of cannabis use.
- Yakovenko, I. The impact of accurate knowledge about vaping and public health initiatives on cannabis use habits of emerging adults.

Polysubstance Use

The effects of legalized nonmedical cannabis use on other substance use is a key public health issue. Studies led by Dr. Jean Costello, Dr. Sameer Imtiaz, Dr. Lindsay Farrell and Dr. Zach Walsh, Dr. Kara Thompson, and Dr. Alasdair Barr examined the use of nonmedical cannabis with alcohol and other drugs.

The Legalization of Cannabis Does Not Appear to Be Associated with Any Major Changes in the Use of Tobacco, Alcohol or Other Substances

Early evidence from the studies led by Costello and by Imtiaz does not appear to show any association between cannabis legalization and alcohol initiation, alcohol use, binge drinking, concurrent or simultaneous cannabis and alcohol use, harmful drinking, or drinking and driving among either students or adults in Ontario. Imtiaz's team also found no conclusive evidence thus far that cannabis serves as a substitute for alcohol or a complement to it. Conversely, Farrell and Walsh's team found that reducing other substance use was a prominent motive for cannabis use among participants, with 17% reporting this as their primary reason for use.

As the legal cannabis market evolves, these trends may also evolve, and this research should be ongoing to better understand the long-term effects of cannabis legalization. Other areas worth exploring are the impact of legalization on alcohol-related outcomes (such as hospitalizations), including among specific subgroups, and the impact of proximity to cannabis stores and alcohol stores on alcohol-related outcomes.

Using Alcohol and Cannabis Together Appears to Be Associated with Higher Risks

In the study led by Thompson, the use of alcohol and cannabis together was a strong predictor of cannabis-related risk of both physical and cognitive effects for male and female university students. In particular, the study found that females might be more vulnerable to cardiovascular risks associated with regular and heavy use of cannabis. In addition, the study led by Barr found that



smoking cannabis appears to be associated with higher rates of alcohol dependence than other forms of cannabis use.

Key Findings and Policy Implications

- Funded research supports maintaining or strengthening regulations that prohibit co-location of alcohol and cannabis sales. It also supports ongoing public health messaging about associated risks.
- The observed associations between the quantity of cannabis and the strength of the product suggest that policies to restrict product potency and milligrams per serving may be valuable harm-reduction tools. Moreover, policies may be considered that prohibit bulk purchases or the sale of products with very high THC levels, such as concentrates.
- As the legal cannabis market continues to evolve, the ways in which people access and consume multiple substances at once will inevitably change, resulting in a need for this research to be closely monitored over time to better understand the long-term effects of cannabis legalization.

Studies referenced in this section (see the Appendix for more details on each):

- Barr, A., & Panenka, W. Understanding the relationship between recreational cannabis use and mental health in a marginalized population.
- Costello, J., & MacKillop, J. Changes in substance use and mental health in two hospital-based addiction treatment programs over the course of recreational cannabis legalization in Canada.
- Farrell, L., & Walsh, Z. Cannabis use among First Nations Peoples of Turtle Island: Motives of use, substitution and impacts of legalization.
- Imtiaz, S., Agic, B., Elton-Marshall, T., Hamilton, H., Mann, R., Shield, K., ... Wickens, C. Evaluating the short-term impacts of cannabis legalization on alcohol consumption, co-occurring cannabis and alcohol consumption, and alcohol consequences among adolescents and adults in Ontario.
- Thompson, K., Watt, M., Goldstein, A., & Asbridge, M. An examination of the sex-specific psychophysiological markers of risk for physical and mental health problems across modes of cannabis use.

Stigma and Responsible Cannabis Use

Despite legalization, stigma surrounding cannabis use persists and can contribute to adverse outcomes. CCSA-funded studies led by Dr. Michael Wohl, Dr. Saara Greene, Dr. Lindsay Farrell and Zach Walsh, and Dr. David Hodgins, and looked at the effects of stigma and ways to promote responsible cannabis use.

The Way Cannabis Use Is Researched and Addressed In Public Policy May Contribute to Stigma

Previous studies have shown that occasional cannabis use poses minimal serious risk to public health (Gabrys & Porath, 2019; Health Canada, 2018; Caulkins et al., 2016), and that the majority of adult consumers do not develop dependencies. Specifically, one in 10 people who consume



cannabis develop some form of dependency (Hasin, 2018). Despite this, most guidelines are based on a deficit model that assumes cannabis use is inherently problematic. As a result, abstinence has been heavily promoted (until recently, abstinence was the only legal option), and there has been very little opportunity to collect evidence or information on responsible cannabis use, policy and practice. According to the study led by Wohl, this longstanding abstinence-based approach may have reinforced and contributed to stigma associated with cannabis use, which may itself be harmful. His team found that when cannabis use is stigmatized, people are more likely to hide or deny their use and may avoid seeking treatment if that use becomes problematic.

As observed by Greene's team, this stigma can be especially pronounced for pregnant people, particularly those who are part of populations already heavily surveilled, including people who are Black, people who are Indigenous (First Nations, Métis and Inuit), people with low socioeconomic status, people with HIV or people with mental health conditions. As noted previously, this stigma may make them hesitant to seek out information and support from healthcare providers, putting them at greater risk of not making evidence-based decisions and of experiencing adverse outcomes.

First Nations and Métis participants in the study led by Farrell and Walsh indicated that while legalization had reduced stigma, they still encountered it. Despite this, a large proportion of participants (57%) still said they had discussed medical cannabis use with their physicians.

Formal Treatment Programs May Not Meet the Needs of All People with Problematic Cannabis Use

According to the study led by Hodgins, the fact that many people with problematic cannabis use do not seek or complete formal treatment is likely related to most of these programs' exclusive focus on abstinence as the only recovery goal, which may not align with cannabis consumers' own goals. Wohl's team found that many cannabis consumers perceive their use as unharmed or even beneficial and engage in various behaviours to monitor their use and keep it from becoming problematic. Based on those behaviours, Wohl and his team developed preliminary scales to assess cannabis use on a spectrum from responsible to problematic and to better recognize early warning signs of potentially problematic use. In addition, Hodgins and his team developed a self-directed workbook to support those who want to reduce, cease or better control their cannabis use on their own terms. In combination with a motivational interview, the workbook was found to be effective at helping cannabis consumers achieve their goals with minimal professional support.



Key Findings and Policy Implications

- Given the harms associated with stigma and concealing cannabis use, more must be done to eliminate the stigma related to cannabis use for all populations.
- Some strategies to eliminate stigma may include developing targeted models of public health and social support for different populations of cannabis consumers as well as tackling stigma within sources of the medical community, such as offering more training to healthcare workers and family physicians.
- Although there are associated risks, not all cannabis use has harmful outcomes. Policies should consider how to balance the need to keep people safe with the need to reduce stigma, and standardized measurement tools should be developed to accurately differentiate between responsible and problematic use.

Studies referenced in this section (see the Appendix for more details on each):

- Farrell, L., & Walsh, Z. Cannabis use among First Nations Peoples of Turtle Island: Motives of use, substitution and impacts of legalization.
- Greene, S. Wading through the weeds: A public health response to pregnant and breast/chestfeeding people who consume cannabis.
- Hodgins, D., & Schluter, M. Addressing potential negative impacts from cannabis legalization: Clinical utility of a brief self-directed intervention for cannabis misuse.
- Wohl, M. Understanding responsible cannabis use.

Voices of First Nations, Métis and Black People

In a study led by Dr. Lindsay Farrell and Dr. Zach Walsh that draws from a large sample of First Nations and Métis communities, motives and modes of cannabis use were assessed among respondents. Another study led by Dr. Saara Greene explored the persisting stigma surrounding cannabis use and associated adverse outcomes among a population of First Nations mothers, Métis mothers and Black mothers.

The process of legalization of nonmedical cannabis in Canada has been criticized for overlooking the concerns and perspectives of populations that have been marginalized by societal systems and decision making, such as Indigenous communities (First Nations, Métis and Inuit) and Black communities. Further, it has revealed the lack of research available that explores the potential for medical cannabis use among Indigenous communities to help treat conditions such as chronic pain, mental health symptoms and reducing use of other substances.

One of the most recent and largest studies conducted by Farrell and Walsh sought to collect some of this information by interviewing First Nations and Métis individuals from across British Columbia and Alberta. Among respondents, key medical motives for consumption observed were to improve sleep and to reduce pain and anxiety. While 85% of respondents reported medical use and 91% reported nonmedical use, a significant majority (75%) reported both types of consumption for managing pain and stress symptoms and helping them focus, relax or both. Further, as reported from other *Closing the Gaps* studies, the distinction between medical versus nonmedical use is somewhat blurred among respondents in Farrell's study, where the overlap was higher, with 75% reporting both



medical and nonmedical use. Consistent with the high levels of medical reasons for use, 57% of all respondents who reported using both medical and nonmedical cannabis reported discussing medical cannabis use with their doctor.

While Farrell's study is one of the first studies of its kind to tackle these research questions related to motives and perceptions around cannabis use among First Nations and Métis people, there is a need for more research to be grounded in anti-oppressive values that acknowledge the histories of racism, colonialism and poverty connected to substance use.

Further, as echoed in other parts of this report, there continues to be ongoing stigma and surveillance with cannabis use in populations that have been marginalized by societal systems. Drawing from Greene's arts-based study using photovoice, there was a deep awareness of the connection between racism and cannabis surveillance in their lives among Black, First Nations and Métis participants. For instance, a First Nations' mother articulated the following:

I'm in a bad place, I'm afraid to call crisis response or to call for help because then automatically ... You have kids so they're going to start opening a CAS [Children's Aid Society] thing ... like that's why I painted my black hand over my face, because it's almost like we want to tell our stories and we want to say our point of view, but like we are so afraid of the consequences of that, that we don't ask questions, we don't find answers, we don't tell our stories. We keep everything inside because we're so afraid of the consequences.

Stigma and surveillance were particularly noted in participants' interactions with child welfare systems and healthcare systems. Participants in Greene's study said they needed more information and education around cannabis consumption during the prenatal period to inform their decision making. They expressed concern that current public health strategies do not reflect the everyday realities of people who want or need to consume cannabis during pregnancy, breastfeeding/chestfeeding and parenthood. Of central importance, the study highlights the need for destigmatizing and harm reduction approaches at the intersection of cannabis education and perinatal care.

Both studies emphasize the need for developing models of public health and social support for people living in communities marginalized by societal systems with limited resources and time. By engaging directly with these communities and better understanding their unique needs and perspectives, these populations can be better supported and equally recognized in the context of legalization.



Key Findings and Policy Implications

- Among a population of First Nations and Métis individuals, key medical motives for cannabis consumption were to improve sleep and reduce pain and anxiety. There was also a high overlap among respondents for reporting use of both medical and nonmedical cannabis.
- The challenge of clearly distinguishing between medical and nonmedical cannabis use makes it difficult for policies to address only one type of use at a time.
- Develop further harm reduction supports during pregnancy through co-creating information and resources related to cannabis and the perinatal period.
- As the legal cannabis market continues to evolve, the ways in which people access and consume multiple substances at once will inevitably change, resulting in a need for this research to be closely monitored over time to better understand the long-term effects of cannabis legalization.

Studies referenced in this section (see the Appendix for more details on each):

- Farrell, L., & Walsh, Z. Cannabis use among First Nations Peoples of Turtle Island: Motives of use, substitution and impacts of legalization.
- Greene, S. Wading through the weeds: A public health response to pregnant and breast/chestfeeding people who consume cannabis.

Next Steps and Further Research Questions

As the Government of Canada undertakes its legislative review of the *Cannabis Act*, the research funded through CCSA's *Closing the Gaps* initiative provides insights into some of the key questions surrounding how legalization has affected the people who use cannabis in Canada. The research looks at the impact of legalization, medical use versus nonmedical use, mental and physical health, purchase decisions, modalities of use, polysubstance use, and stigma. While this research offers valuable new information, it is important to acknowledge that we are still in the early days of legalization, and market expansion, attitudes and long-term effects will likely evolve as time goes on. For this reason, it is vital that research of this kind continues so we can further our understanding of nonmedical cannabis and its effects on individual and public health.

In addition, many questions remain that could not be fully explored within the context of this research program. However, they should be investigated to ensure policies can be developed that meet the needs and promote the health of all people in Canada who use cannabis. These topics include:

- While raising the legal minimum age in Quebec does not appear to have diverted youth toward unlicensed sources, more research is needed to determine if some youth substituted cannabis for other substances, such as tobacco or alcohol.
- More research is needed to better understand the interactions between cannabis and other drugs, including prescription medications, as well as the relationship between cannabis use and mental illness diagnoses.



- A better understanding is needed of the risk factors for adverse mental health outcomes, especially among youth.
- There is an urgent need for more robust evidence on the effects of cannabis on all aspects of pregnancy and breastfeeding/chestfeeding, including parental mental health and quality of life.
- A more thorough understanding of the factors and behaviours that promote or hinder responsible cannabis use would support the development of policies and programs that would better serve those who need help to reduce, cease or better control their cannabis use.
- More robust evidence on the use of cannabis for pain, mental health challenges and sleep difficulties is required to meet the needs of people who use cannabis to treat these issues and believe it to be effective.
- There remain gaps in our understanding of the potential risks of less commonly used modes and how patterns of cannabis use may vary between different sexes or genders.
- An in-depth risk–benefit analysis should be conducted on changes to the legal availability of vaping products and the possibility of raising THC limits.

The *Closing the Gaps* initiative provides critical understandings to help policy makers, decision makers and other interested parties make evidence-informed decisions pertaining to cannabis use. Additionally, the initiative sets the groundwork for future research to build on and explore less understood areas of cannabis use and cannabis legalization and their impacts on marginalized populations and equity-deserving groups. Given the ever-evolving landscape of the cannabis market and its legal implications, it is important that this type of up-to-date, transparent, evidence-informed research is available to all levels of government, policy makers, researchers and consumers.



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Appendix

The *Closing the Gaps* program included the following studies. Where available, study authors' publications related to their research topics are also listed.

Addressing Potential Negative Impacts of Cannabis Legalization: Clinical Utility of a Brief Self-Directed Intervention for Cannabis Misuse

Principal investigator: David C. Hodgins

Project summary This research pilot tested the clinical utility of a brief self-directed intervention for individuals with problematic cannabis use who wanted to recover with minimal professional support. Two options were compared to a waitlist control group: a self-help workbook plus a brief motivational telephone interview, and the workbook without any telephone contact. The results show that a self-directed workbook in combination with a motivational interview helped improve rates of abstinence and reduce the frequency and quantity of cannabis use. Given that many individuals with problematic cannabis use do not seek formal treatment, this self-directed intervention has the potential to fill an important need by attracting individuals who want to recover with minimal professional support.

Publications to date:

Schluter, M. G., Hodgins, D. C., Stea, J. N., & Kilborn, M. L. (2022). Promoting self-change in cannabis use disorder: Findings from a randomized trial. *Frontiers in Psychiatry*, 13. Article 1015443. <https://doi.org/10.3389/fpsy.2022.1015443>

Cannabis and Polysubstance Use

Principal investigator: Christian Schütz

Project summary: This study explored the risk and potential benefits of THC and CBD use among those with severe polysubstance use via a systematic review and through participant interviews. A pilot study with 12 participants was run to determine the safety and tolerability of CBD among those who use multiple substances and have a history of psychosis. Preliminary findings from animal and preclinical studies suggest that CBD may mitigate the negative effects of THC as well as reduce anxiety, impulsivity and craving associated with alcohol, stimulants and opioid use.

Note: *This project was not yet completed at the time of publication of this report.*

Cannabis Use Among Indigenous Peoples of Turtle Island: Motives for Use, Substitution and Impacts of Legalization

Principal investigators: Lindsay Farrell and Zach Walsh

Project summary: This project looked at motives for cannabis use among Indigenous Peoples of Turtle Island living in British Columbia and Alberta, with an emphasis on assessing risk for problematic use and potential benefits of personal use to improve well-being for symptoms of chronic pain, anxiety and sleep. The researchers further investigated how cannabis use affects the use of other medications and substances, as well as perceptions of cannabis access among the Indigenous population. Researchers observed roughly equivalent levels of medical and personal motives among the sample of Indigenous Peoples using cannabis, with a large majority of



respondents reporting both medical and personal motives for use. Smoking cannabis flower was the most popular mode of use, followed by consuming edible cannabis. The use of vapes and concentrates was relatively infrequent. The most prominent motives in support of well-being were to improve sleep, reduce pain and reduce anxiety. Although respondents reported stigma around cannabis use, the legalization of cannabis was perceived to help reduce stigma. It also provided access to a greater variety of products, although price remained a barrier.

Changes in Substance Use and Mental Health in Two Hospital-based Addiction Treatment Programs Over the Course of Recreational Cannabis Legalization in Canada

Principal investigator: Jean Costello

Project summary: This project examined the effect of legalization on cannabis and other substance use among two clinical samples of patients entering treatment for SUD or concurrent disorders. It also explored the associations between cannabis use, other substance use and common psychiatric symptoms (including depression, anxiety and PTSD) among the two clinical samples. Researchers found legalization of nonmedical cannabis, at least in this early stage, has not led to substantive increases in cannabis use or CUD symptom severity, nor has it led to a decrease in readiness to quit in two samples of individuals with SUD. Similarly, there were no significant changes pre- and post-legalization in the prevalence of tobacco, alcohol or other drug use within these two samples. These findings provide insight into the early effects of legalization on individuals with SUD and highlight the importance of considering CUD and psychiatric comorbidities in future cannabis policy and monitoring efforts.

Publications to date:

Costello, M. J., Cooper, A., Sousa, S., Li, Y., Chorny, Y., Brasch, J., & MacKillop, J. (2023). Examining the potential impact of legalizing nonmedical cannabis in Canada: An interrupted time series study of cannabis use in two substance use disorder treatment settings [Manuscript submitted for publication].

Costello, M. J., Cooper, A., Sousa, S., Chorny, Y., Brasch, J., & MacKillop, J. (2023). Exploring the associations between cannabis use, other substance use and common psychiatric symptoms [Manuscript in preparation].

Choice Modelling Study to Explore Canadian Consumer Preferences for Attributes of Cannabis Products and Purchase Experiences

Principal investigator: Jennifer Donnan

Project summary: This research examined consumer preferences for the different varieties of cannabis products and compared and contrasted consumer preferences across Canada in relation to different provincial policies and cultures. The results show that consumers make their cannabis purchase decisions based on product characteristics (e.g., price, product type, CBD content, THC content), the shopping experience and their own demographics and social influences. The findings of this study have direct policy and regulatory implications, suggesting the need to explore package design and cannabis quality standards, and to conduct risk–benefit analyses of vaping products and THC content of cannabis edibles.

Publications to date:



Donnan, J., Shogan, O., Bishop, L., Swab, M., & Najafizada, M. (2022). Characteristics that influence purchase choice for cannabis products: A systematic review. *Journal of Cannabis Research*, 4, Article 9. <https://doi.org/10.1186/s42238-022-00117-0>

Donnan, J., Shogan, O., Bishop, L., & Najafizada, M. (2022). Drivers of purchase decisions for cannabis products among consumers in a legalized market: A qualitative study. *BMC Public Health*, 22, Article 368. <https://doi.org/10.1186/s12889-021-12399-9>

Evaluating the Short-Term Impacts of Cannabis Legalization on Alcohol Consumption, Co-occurring Cannabis and Alcohol Consumption, and Alcohol Consequences Among Adolescents and Adults in Ontario

Principal investigator: Sameer Imtiaz

Project summary: This study examined the impacts of cannabis legalization on changes in alcohol consumption, co-occurring cannabis and alcohol consumption, and alcohol consequences. The researchers found no evidence among students in Ontario from 2001–2019 that cannabis legalization was associated with alcohol initiation, alcohol use, binge drinking, concurrent cannabis and alcohol use, simultaneous cannabis and alcohol use, hazardous or harmful drinking, or driving after drinking two or more drinks. A similar lack of evidence was found for adults in Ontario from 2001–2019. The study also found no evidence that cannabis legalization was associated with treatment admissions for alcohol-related problems or comorbid cannabis- and alcohol-related problems in Ontario between fiscal years 2008–2009 and 2019–2020 and no evidence that cannabis legalization was associated with per capita litres of ethanol sold per week in Ontario between fiscal years 2016/17 and 2019/20.

An Examination of the Sex-Specific Psychophysiological Markers of Risk for Physical and Mental Health Problems Across Modes of Cannabis Use

Principal investigator: Kara Thompson

Project summary: This research study used daily diary methodology among a sample of young adults to investigate risk markers for physical and mental health disorders across modes of cannabis use, as well as sex- and gender-specific impacts on cannabis use practices and effects across modes of use. Researchers found that cannabis quantity, strength, mode of use and co-use with alcohol were all independently and additively predictive of physical and cognitive health risks. Co-use with alcohol was a robust predictor of cannabis-related risks for males and females. Mode of use was more strongly associated with risks for males compared to females. Bongs and vaporizers were associated with higher reported physical effects for males while hand pipes, vaporizers and edibles were associated with higher cognitive symptoms. However, the impact of cannabis use on physiological health risks was more significant for females than males, meaning that females who use cannabis may be uniquely vulnerable to cannabis-related risks. There remain gaps in our understanding of the potential risks of less commonly used modes.

Publications to date:

Kuhathasan, N., Ballester, P. L., Minuzzi, L., MacKillop, J., & Frey, B. N. (2023). Predictors of perceived symptom change with acute cannabis use for mental health conditions in a naturalistic



sample: A machine learning approach. *Comprehensive Psychiatry*, 122, Article 152377.
<https://doi.org/10.1016/j.comppsy.2023.152377>

MacDonald-Spracklin, R., DeWolf, D., & Thompson, K. (2023). Investigating the acute health effects of simultaneous alcohol and cannabis use [Manuscript submitted for publication].

Thompson, K., DeWolf, D., & Thibault, T. (2023). Associations between mode of use and cannabis related risks [Manuscript in preparation].

Thompson, K., Thibault, T., & Peters, A. L. (2023). A better high? Understanding mode preferences among young adult cannabis users. *Canadian Journal of Behavioural Science / Revue canadienne des sciences du comportement*. Advance online publication.
<https://doi.org/10.1037/cbs0000368>

A Gender- and Age-Based Analysis of Cannabis Use for Pain and Mental Health in a Large Canadian Naturalistic Sample

Principal investigator: Benicio Frey

Project summary: This study conducted age- and gender-based analyses on the profile of cannabinoid use for pain and mental health conditions. More specifically, it focused on the different patterns of cannabis use and methods of cannabis consumption in a large, naturalistic sample of people in Canada to determine the most prevalent methods of cannabis consumption for individuals managing pain and mental health conditions. The results from this study suggest that gender and age may have a larger impact on cannabis use than previously reported. Individuals who self-identified as female between the ages of 25 and 34 years consumed cannabis most often to manage their pain and mental health symptoms. The study also found that smoking and vaping were the most common methods of ingestion for both pain and mental health conditions. However, younger adults were more likely to smoke the product, while older adults were more likely to vape.

Health Warnings, Product Labelling Regulations and Consumer Understanding of the Health Risks of Cannabis

Principal investigators: Samantha Goodman and David Hammond

Project summary: This project used survey data from the International Cannabis Policy Study to examine changes in knowledge and perceptions of health risks before and after nonmedical cannabis legalization. It also looked at the effectiveness of the health warnings used on Canadian cannabis products and their impact on knowledge of cannabis health risks. The researchers used focus groups to gain in-depth information about consumer perceptions of health warnings two years post-implementation and found that legalization was associated with greater recall of health warning messages. Awareness of specific warning messages was highest in jurisdictions where the associated warning was mandated on packages, suggesting that warning labels may improve knowledge of cannabis-related health risks. However, consumers continue to report confusion and difficulty in understanding THC and CBD labels, suggesting a need for further refinement in terms of language level, relatability to target populations and distinct forms of use. Lastly, branded packs without health warnings were perceived to be of lower quality and safety and perceived to be more harmful to health when compared to packs that bear health warnings or THC labels.

Publications to date:



Goodman, S. & Hammond, D. (2021). Noticing of cannabis health warning labels in Canada and the US. *Health Promotion and Chronic Disease Prevention in Canada*, 41(7/8), 201–210. <https://doi.org/10.24095/hpcdp.41.7/8.01>

Goodman, S., & Hammond, D. (2022). Perceptions of the health risks of cannabis: Estimates from national surveys in Canada and the United States, 2018–2019. *Health Education Research*, 37(2), 61–78. <https://doi.org/10.1093/her/cyac006>

Goodman, S., Leos-Toro, C., & Hammond, D. (2022). Do mandatory health warning labels on consumer products increase recall of the health risks of cannabis? *Substance Use & Misuse*, 57(4), 569–580. <https://doi.org/10.1080/10826084.2021.2023186>

Goodman, S., Rynard, V. L., Iraniparast, M., & Hammond, D. (2021). Influence of package colour, branding and health warnings on appeal and perceived harm of cannabis products among respondents in Canada and the US. *Preventive Medicine*, 153, Article 106788. <https://doi.org/10.1016/j.ypmed.2021.106788>

The Impact of Accurate Knowledge About Vaping and Public Health Initiatives on Cannabis Use Habits of Emerging Adults

Principal investigator: Igor Yakovenko

Project summary: This project looked at the accuracy of knowledge about vaping cannabis among emerging adults in Canada; the effects of poorer knowledge on perceptions of vaping-related harms; the information emerging adults deem trustworthy and use to inform their decision making; and gender differences in the relationship between vaping knowledge, perceived harm of vaping and substance use problem severity. The results show that adults in Canada aged 18–30 years who vape cannabis regularly are not fully knowledgeable about what vaping is and how harmful it is. In particular, individuals who had less knowledge about vaping reported greater vaping frequency and were at greater risk for CUD. The study also found that young people in Canada who vape adhere to few of the recommended lower-risk cannabis use guidelines, endorsing an average of four out of 10 recommended behaviours. These results provide the first empirical data on the relationship between cognitive risk factors of substance use and cannabis vaping in emerging adults.

Publications to date:

Belliveau, J., & Yakovenko, I. (2022). Evaluating and improving the quality of survey data from panel and crowdsourced samples: A practical guide for psychological research. *Experimental and Clinical Psychopharmacology*, 30(4), 400–408. <https://doi.org/10.1037/pha0000564>

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Tang, K. T. Y., Belliveau, J. L., Al-Hamdani, M., & Yakovenko, I. (2023). Beliefs, attitudes, and perceptions about vaping predict increased cannabis and nicotine problems in emerging adult vapers [Manuscript submitted for publication].

Tang, K. T. Y., Loverock, A., Otis, E., Wild, T. C., & Yakovenko, I. (2023). The role of motives in understanding the association between personality and cannabis misuse [Manuscript submitted for publication].



Impacts of Canada's Nonmedical Cannabis Legalization on Youth Cannabis Use and Medical Cannabis Consumption

Principal investigator: Hai V. Nguyen

Project summary: This three-part study investigated the effects of Canada's nonmedical cannabis legalization on nonmedical cannabis use among Canadian youth, looked at whether raising the minimum legal age in Quebec reduced youth cannabis use and examined the effects of legalization on medical cannabis use. In the first study, researchers found that while cannabis initiation among youth aged 15–18 years increased by 69% after legalization, there was no increase in the overall prevalence of cannabis use in this age group. This suggests that there was likely an offsetting increase in cannabis cessation among youth who were previously using cannabis. The second study found that after Quebec increased its minimum legal age to 21 years from 18, there was no significant change in use patterns among youth aged 15–17 years. However, the increase in past three-month cannabis use among youth aged 18–20 years was 51% lower in Quebec than in other provinces. This change was explained by a reduction in past three-month cannabis initiation in Quebec in this age group. The third study found that provinces with more lenient medical cannabis authorizing policies, fewer illegal dispensaries and smaller increases in nonmedical prices experienced larger reductions in medical use after legalization. These findings suggest that those who were using cannabis for medical reasons switched to the nonmedical market, the illicit market or both after legalization.

Publications to date:

Nguyen, H. V., Mital, S., & Bornstein, S. (2023). Short-term effects of recreational cannabis legalization on youth cannabis initiation. *Journal of Adolescent Health, 72*(1): 111–117. <https://doi.org/10.1016/j.jadohealth.2022.09.003>

Nguyen, H. V. & Mital, S. (2022). Changes in youth cannabis use after an increase in cannabis minimum legal age in Quebec, Canada. *JAMA Network Open, 5*(6), Article e2217648. <https://doi.org/10.1001/jamanetworkopen.2022.17648>

Nguyen, H. V., Grootendorst, P., Mital, S., Bishop, L., & McGinty, E. E. (2023). Changes in medical cannabis use after recreational cannabis legalization in Canada. *Cannabis and Cannabinoid Research*. Advance online publication. <https://doi.org/10.1089/can.2022.0227>

Public Health Outcomes of Cannabis Supply Sources: Examining the Evidence Among Quebec Cannabis Consumers

Principal investigator: Didier Jutras-Aswad

Project summary: This project aimed to determine whether the source of cannabis supply reported by people living in Quebec is associated with specific patterns of cannabis use and increased vulnerability to cannabis-related harms such as problematic cannabis use, mental health problems and cannabis-impaired driving. The results showed that people who obtained their cannabis from sources other than government-run cannabis retailers (GCRs) were significantly more likely to be unaware of the cannabinoid content of the products they purchased. The results also suggested that vulnerability profiles of the population sourcing cannabis from a GCR were similar to those of the broader population of people who use cannabis, while no associations were detected with other potential indicators of vulnerability to cannabis use. Overall, this suggests that vulnerable people who use cannabis may be reached by GCRs in Quebec.



Publications to date:

Drouin, S., Rizkallah, É., Conus, F., Larney, S., Kaur, N., Djignefa Djade, C., & Jutras-Aswad, D. (2023). Association between markers of vulnerability for cannabis-related harms and source of supply: Secondary analysis of a representative population survey. *The Canadian Journal of Psychiatry*, 68(2), 109–118. <https://doi.org/10.1177/07067437221128470>

Transitioning to the Legal Cannabis Market in Canada

Principal investigators: Elle Wadsworth and David Hammond

Project summary: This study examined sources of cannabis purchases in Canada, including legal and illegal retail sources, and the policy and individual-level factors associated with purchasing patterns and transitioning to the legal market. The results showed that the percentage of consumers purchasing all their cannabis legally varied across the provinces but that at least half of consumers in all provinces were purchasing all their cannabis legally in 2021. It appears that greater percentages of consumers are transitioning to the legal market, but some groups seem to be transitioning more slowly than others (e.g., daily consumers versus less frequent consumers). Higher prices and the inconvenience of legal sources were cited by consumers as common barriers to sourcing cannabis legally, while other reasons varied across the provinces. Despite some provincial variation, findings indicate that, overall, the legal cannabis market is growing and the percentage of cannabis consumers in Canada sourcing cannabis legally is increasing.

Publications to date:

Goodman, S., Wadsworth, E., & Hammond, D. (2022). Reasons for purchasing cannabis from illegal sources in legal markets: Findings among cannabis consumers in Canada and U.S. states, 2019–2020. *Journal of Studies on Alcohol and Drugs*, 83(3), 392–401. <https://doi.org/10.15288/jsad.2022.83.392>

Understanding Cannabis-Related Physical and Mental Health Presentations To The Emergency Department Following Legalization Of Nonmedical Cannabis Use

Principal investigator: Philip G. Tibbo

Project summary: This project investigated adverse events in relation to cannabis use requiring emergency department services, including associated risk factors and healthcare demands. This was a unique collaborative emergency medicine and psychiatry study. The researchers found that cannabis-related presentations to the emergency department have increased in number since legalization. More than half (57%) of the cannabis-related presentations were related to physical health, while 43% were related to mental health. Physical presentations ranged from chest pain to allergic reaction. Greater awareness is needed around the possibility of drug–drug interactions with cannabis, particularly for individuals taking psychiatric medications for depression and anxiety, as cannabinoids such as THC can alter drug clearance rates, increasing the risk of adverse interactions.

Publications to date:

Crocker, C. E., Carter, A. J. E., Emsley, J. G., Magee, K., Atkinson, P., & Tibbo, P. G. (2021). When cannabis use goes wrong: Mental health side effects of cannabis use that present to emergency services. *Frontiers in Psychiatry*, 12. <https://doi.org/10.3389/fpsy.2021.640222>



Crocker, C. E., Emsley, J., & Tibbo, P. G. (2023). Mental health adverse events with cannabis use diagnosed in the emergency department: What are we finding now and are our findings accurate? *Frontiers in Psychiatry*, 14, Article 1093081. <https://doi.org/10.3389/fpsyt.2023.1093081>

Understanding Cannabis Use And Perceptions in Patients with Mood and Anxiety Disorders

Principal investigator: Stefan Kloiber

Project summary: This study looked at knowledge gaps and uncertainties related to cannabis use patterns as well as the knowledge, motivations and perceptions of cannabis use in individuals with mood and anxiety disorders, OCD or PTSD. A mixed-methods approach was used, which included an anonymous survey, qualitative interviews and a systematic review of the literature. Results from interviews indicate that about half of individuals reported initiating cannabis use before the age of 18 years. Curiosity, peer pressure and acceptance, and treatment of mental health symptoms were among the most common motives. Most individuals (more than 60%) with specific mental health conditions who completed the anonymous survey reported that they perceived their cannabis use to be for medical reasons. An additional risk identified was that 53.1% of individuals obtained products from unregulated sources. The systematic review also revealed potential risk constellations such as anxiety sensitivity, social anxiety and depression being more frequently associated with cannabis use and increased risk for problems related to cannabis use.

Understanding Responsible and Harmful Cannabis Use

Principal investigator: Michael Wohl

Project summary: This project addressed gaps in knowledge on responsible cannabis use strategies and social psychological predictors of engagement in responsible versus harmful cannabis use. It also included the development of a reliable and valid tool to measure responsible cannabis use beliefs and behaviours. In a rapid evidence assessment of existing research on responsible cannabis consumption, the researchers identified 1,887 unique articles published between January 1, 2011, and August 30, 2021. Three themes emerged that reflect responsible cannabis beliefs and behaviours: informed self-regulation, protective behavioural strategies and normalization of cannabis consumption. An additional theme reflected motivations that undermine responsible cannabis consumption: using cannabis to cope. Results suggest a need for targeted research focused on how those who consume cannabis responsibly do so in a positive, healthy manner. Following a series of analyses, researchers created a 21-item Cannabis Lower-Risk Scale, the first evidence-based tool to assess responsible cannabis use.

Publications to date:

St-Jean, R., Dowson, M. E., Stefaniak, A., Salmon, M. M., Tabri, N., Wood, R. T. A., & Wohl, M. J. A. (2022). Understanding lower-risk cannabis consumption from the consumers' perspective: A rapid evidence assessment. *Substance Use & Misuse*, 57(13), 1997–2007. <https://doi.org/10.1080/10826084.2022.2129996>

St-Jean, R., Stefaniak, A., Salmon, M. M., Tabri, N., Wood, R. T. A., & Wohl, M. J. A. (2022). The Cannabis Lower-Risk Scale: Psychometric validation of a multidimensional measure of lower-risk cannabis beliefs and behaviors. *International Journal of Mental Health and Addiction*. <https://doi.org/10.1007/s11469-022-00925-8>



Understanding the Relationship Between Recreational Cannabis Use and Mental Health in a Marginalized Population

Principal investigator: Alasdair M. Barr

Project summary: The goal of this study was to characterize cannabis use within a marginalized disadvantaged cohort in Vancouver, given the known significantly higher rates of mental health issues compared to the general population, and to identify subgroups at risk. This investigation found no significantly different patterns of use between young people and adults. It also found no evidence of elevated incidence of adverse mental health outcomes among young people. Smoking cannabis was highly prevalent in this population, and education was found to be a key factor for harm reduction. Among those who preferred smoking, intent and patterns of use appeared to be more similar to those who use cannabis for recreational purposes. Findings of high rates of problematic cannabis use in this cohort also suggest that individuals who are self-treating with cannabis may be at increased risk for developing adverse outcomes, such as CUD, compared to those receiving guidance from a healthcare practitioner.

Publications to date:

Lo, L. A., MacCallum, C. A., Yau, J. C., & Barr, A. M. (2022). Differences in those who prefer smoking cannabis to other consumption forms for mental health: What can be learned to promote safer methods of consumption? *Journal of Addictive Diseases*, 41(3), 258–262.

<https://doi.org/10.1080/10550887.2022.2107332>

Lo, L. A., MacCallum, C. A., Yau, J. C., Panenka, W. J., & Barr, A. M. (2022). Factors associated with problematic cannabis use in a sample of medical cannabis dispensary users. *Psychiatry and Clinical Psychopharmacology*. 2(3), 262–267. <https://doi.org/10.5152/pcp.2022.22358>

Lo, L. A., MacCallum, C. A., Yau, J. C., Panenka, W. J., & Barr, A.M. (2023). Are younger medical cannabis users at risk? Comparing patterns of use and mental health in younger and older medical cannabis dispensary users. *Children and Teenagers*. 6(2), 1–14.

<https://doi.org/10.22158/ct.v6n2p1>

Wading Through the Weeds: A Public Health Response to Supporting Pregnant and Breastfeeding/Chestfeeding People Who Consume Cannabis

Principal investigator: Saara Greene

Project summary: Using the arts-based method of photovoice, this study aimed to contribute to the development of culturally responsive public health practices and policies that reflect the needs and experiences of Indigenous people, Black people and people of colour, as well as parents who have child welfare involvement and people who consume cannabis during pregnancy and breastfeeding/chestfeeding. The project reiterated that participants from marginalized identities, including Black and Indigenous parents and parents living with visible and invisible disabilities, faced more cannabis-related stigma and surveillance. Stigma and surveillance were particularly noted in participants' interactions with the child welfare systems and the healthcare systems. Participants in this study said they needed more information and education about cannabis consumption during the prenatal period to inform their decision making. They expressed concern that current public health strategies do not reflect the everyday realities of people who want or need to consume cannabis during pregnancy, breastfeeding/chestfeeding and parenthood. Of central importance, the study



highlights the need for destigmatizing and harm reduction approaches at the intersection of cannabis education and perinatal care.

Publications to date:

Kozak, T., Ion, A., & Greene, S. (2022). Reimagining research with pregnant women and parents who consume cannabis in the era of legalization: The value of integrating intersectional feminist and participatory action approaches. *Cannabis and Cannabinoid Research*, 7(1), 11–15.
<https://doi.org/10.1089/can.2020.0086>