Clearing the Smoke on Cannabis

Highlights

This report highlights key findings from the Clearing the Smoke on Cannabis series. This Series consists of seven reports that review the current evidence related to the effects of cannabis use on various aspects of human health, functioning and development. The series covers 1) *Regular Use and Mental Health*, 2) *Maternal Cannabis Use during Pregnancy*, 3) *Cannabis Use and Driving*, 4) *Respiratory and Cardiovascular Effects of Cannabis Smoking*, 5) *Medical Use of Cannabis and Cannabinoids*, 6) *Regular Use and Cognitive Functioning*, and 7) *Edible Cannabis Products, Cannabis Extracts and Cannabis Topicals*. This series is intended for a broad audience, including health professionals, policy makers and researchers.

What Is It?

- Cannabis is a greenish or brownish material consisting of the dried flowering, fruiting tops and leaves of the cannabis plant, *Cannabis sativa*.

- Cannabis is known by many names, including marijuana, weed, hash and others.

- Cannabis can be consumed by smoking, vaporization (or "vaping"), ingestion (edible cannabis), oral application of tinctures, and by topical application of creams, oils and lotions.

- On October 17, 2018, cannabis, including dried cannabis and some oils, was made legal for non-medical use by those of legal age (18 or 19, depending on the province or territory).

- On October 17, 2019, edible cannabis products, cannabis extracts and cannabis topicals were permitted for legal sale and purchase. These products carry with them unique health and safety risks that differ from dried cannabis.

Canadian Centre **on Substance Use and Addiction**

Evidence. Engagement. Impact.

Who Is Using It?

- 17.1% of Canadians over the age of 15 or about 5.2 million Canadians report using cannabis in the past three months (Statistics Canada, 2019).

- Cannabis use is more prevalent among **males** (20.3%) than **females** (14%) (Statistics Canada, 2019).

- Cannabis use is most common among individuals 15 to 24 (27.0%) and 25 to 44 (25.5%), followed by those who are 45 to 64 (10.1%) and 65 or older (7.6%), (Statistics Canada, 2019).

What Does Regular Use Mean?
What Does Heavy Use Mean?

Researchers do not have a single definition for what constitutes **regular cannabis use**, but in general the term refers to weekly or more frequent use over periods of months or years, and that poses a risk for adverse health effects. Terms that are often used interchangeably with regular use include frequent use, chronic use and long-term use. **Heavy use**, on the other hand, typically refers to daily or more frequent use, and can increase the risk for developing dependence and cannabis use disorder.

What's the Issue?

Legalization of cannabis for non-medical purposes has increased its accessibility and availability for many individuals living in Canada (those over 18 or 19, depending on the province or territory). The diversity of cannabis products available for use will become even greater following the legalization of "new cannabis products," which include edible cannabis, cannabis extracts and cannabis topicals. Despite its legalization and promising research for its medical application, regular use of cannabis can lead to adverse health outcomes. Regular cannabis use can affect:

- Mental health

- Cognitive functioning, including attention and memory

- Respiratory and cardiovascular health

- The developing child when used during pregnancy and breastfeeding

Cannabis use can also negatively impact a person's ability to drive a motor vehicle, operate heavy machinery and perform optimally in safety-sensitive occupations.

High on Cannabis — What Does that Mean?

Signs of cannabis intoxication — "being high" on cannabis — include euphoria and relaxation, increased self-awareness, introspection and creative thought, increased heart rate, decreased attention span, slowed reaction times and a lack of a sense of time. These effects can last up to six hours when inhaling cannabis (smoking or vaping) and up to 12 hours when ingesting cannabis. Some residual effects, such as drowsiness, can last up to 24 hours. Cannabis over-intoxication can occur after consuming too much tetrahydrocannabinol (THC) at one time. Symptoms of over-intoxication include severe anxiety, vomiting and paranoia.

Edible Cannabis Products, Cannabis Extracts and Cannabis Topicals

Definition: *Edible cannabis* (or edibles for short) refers to food and beverage products that have cannabis (or cannabinoids) infused into them. These include cookies, brownies, soft chews (or gummies), teas and juices.

Definition: *Cannabis extracts* are products that contain cannabinoids that have been extracted from the cannabis plant. The term "concentrate" is generally applied to cannabis extracts containing high concentrations (e.g., ~ 60%) of THC.

Definition: *Cannabis topicals* are cannabinoid-infused oils, creams and lotions that are intended for application directly to the skin, hair or nails.

On October 17, 2019, Canada legalized "new cannabis products," which include edible cannabis products, cannabis extracts and cannabis topicals.

Key Findings:

- It can take up to four hours to feel the full effects of edible cannabis, and the intoxicating ("high") and impairing effects can last up to 12 hours. Some residual effects, such as drowsiness, can last up to 24 hours.

- Cannabis extracts with high THC content (i.e., concentrates) significantly increase the risk of over-intoxication.

- Regular use of cannabis concentrates is associated with tolerance, withdrawal and cannabis use disorder.

- Cannabis topicals are being used for medical (e.g., to manage peripheral pain and arthritis) and cosmetic (skincare and haircare) purposes. The effectiveness of cannabis topicals for any condition has not been well-studied.

Implications:

- These new products carry with them additional and unique health and safety risks, not present with dried cannabis, of which Canadians are not fully aware.

- Sustained public education efforts will be central to minimizing the potential harms, including how to prevent over-intoxication and dependence, and the unintentional ingestion of cannabis by children.

- It will be important for future research to expand the measurement of cannabis use to include edible cannabis, cannabis extracts and cannabis topicals to understand long-term health impacts of these products.

Regular Use and Mental Health

Definition: *Cannabis use disorder,* as defined by the *Diagnostic and Statistical Manual of Mental Disorders* (fifth edition), refers to a problematic pattern of use leading to clinically significant impairment or distress.

Key Findings:

- Regular cannabis use can increase the risk of developing psychosis and schizophrenia. The risk is greatest among individuals with i) a family history of these illnesses, ii) those who use cannabis heavily, iii) those who use products containing high amounts of THC, and iv) those who begin use early in life (i.e., before the age of 16 or 17).

- It is presently not clear the extent to which regular cannabis use leads to depression or anxiety, after accounting for common factors (e.g., socioeconomic status, alcohol use).

- However, problematic cannabis use and cannabis use disorder is more common among individuals with mood and anxiety disorders compared to those who are not experiencing these conditions.

- Regular cannabis use is generally associated with more harms than benefits among individuals with mental health conditions.

Implications:

- Efforts to inform the public, such as through public education campaigns, must increase awareness of the risks of regular cannabis use on mental health outcomes, especially among individuals experiencing or at risk of developing mental illness.

- Public education messaging should emphasize the importance of delaying or limiting the use of cannabis as much as possible, and avoiding the use of large amounts of cannabis and cannabis products with high concentrations of THC.

- Increasing the capacity of those who work with youth and other at-risk populations by providing them with the necessary tools and resources could also reduce the mental health harms associated with regular cannabis use.

- Standardized measurement of cannabis use and more robust, well-designed prospective studies are needed to better understand the effects of regular use on mental health outcomes.

Regular Use and Cognitive Functioning

Definition: *Cognitive functioning* refers to a set of mental skills that individuals use to carry out everday activities. These mental skills include learning and memory, attention span, impulse control and decision making.

Key Findings:

- Regular cannabis use can result in mild, but measurable, cognitive difficulties. These effects generally dissipate after a prolonged period of abstinence (several weeks to a month).

- If cognitive impairment is present in individuals who use cannabis regularly, it is typically among those who began using prior to the age of 16 or 17.

- Regular cannabis use is associated with differences in brain structure, including differences to the brain's natural reward pathways. However, it is not clear whether using cannabis regularly leads to changes in the brain or whether brain differences pre-date the onset of regular cannabis use.

- When performing simple tasks, the brains of individuals who use cannabis regularly have to work harder then the brains of individuals who do not use cannabis regularly.

- Individuals who display risky and impulsive decision making are more likely to develop problematic cannabis use and cannabis use disorder.

Implications:

- Informing the public about the risks of regular cannabis use on cognitive function, such as through educational campaigns, can help Canadians make informed decisions about using cannabis.

- Investments in evidence-informed prevention and educational initiatives could delay the initiation of use among youth and reduce the frequency of cannabis use, which could reduce the potential harms.

- Supporting and building the capacity of youth allies by providing them with the necessary resources and tools could also reduce the harms of cannabis use by youth.

- There is a need for a standardized measurement of cannabis use and more robust, well-designed perspective studies to better understand the effects of regular use on cognitive functioning.

Cannabis Use and Driving — An Update

Definition: *Drug-impaired driving* refers to the operation of a motor vehicle, including snowmobiles, all-terrain vehicles, boats, trains and airplanes, while one's ability is adversely affected by a drug, including illegal drugs, prescription drugs, over-the-counter medications and volatile inhalants such as toluene or nitrous oxide.

Drug-impaired Driving Laws

A "per se" law refers to a legally established threshold or limit for the presence of alcohol or drugs in the body. Surpassing this threshold is presumed to be associated with impairment and, when operating a motor vehicle, is an impaired driving offence. Exceeding 80 milligrams of alcohol in 100 millilitres of blood (80 mg/dL) while operating a motor vehicle, for example, is a criminal offence under the Criminal Code of Canada.

For cannabis, there are two limits for THC:

1. Two nanograms in one millilitre (two ng/ml) of whole blood, but less than five ng/ml is a summary conviction offence.

2. Five ng/ml in whole blood for a hybrid (summary conviction or indictable) offence.

It is also a hybrid offence to have 2.5 ng/ml or more THC combined with 50 mg (or more) of alcohol per 100 mL blood. In addition to the per se limits set by the federal government, provincial and territorial governments also set administrative sanctions (e.g., suspensions, fines, vehicle impoundment) to strengthen impaired driving laws.

Law enforcement with specialized training in the Drug Evaluation and Classification program, known as Drug Recognition Experts (DREs), can also legally determine impairment. The DRE assessment includes psychophysical, behavioural and bodily fluid tests (usually blood), as well as the collection of other information (e.g., medical) on drivers reasonably suspected to be impaired. The evaluation is based on scientific evidence and DRE evaluations are legally recognized as admissible in court and the DRE as an expert witness.

For more information, ccsa.ca/policy-and-regulations-impaired-driving

Key Findings:

- Among young drivers in Canada, driving after using cannabis is more prevalent than driving after drinking.

- Males are twice as likely as females to report driving after using cannabis.

- Cannabis impairs the cognitive and motor abilities necessary to operate a motor vehicle and doubles the risk of crash involvement.

- After alcohol, cannabis is the most commonly detected substance among drivers who die in traffic crashes in Canada.

- The police have the tools and authority required to detect and arrest drivers who are impaired by cannabis.

Effects of Cannabis on Driving Performance

Cannabis can compromise a driver's reaction time and visual ability. While experienced drivers might be able to compensate for some of these effects, decreased attention and impaired decision making can increase the likelihood of a crash.

Implications:

- Increased use of cannabis in Canada can contribute to increasing rates of cannabis-impaired driving. Efforts to prevent, reduce or delay cannabis use, especially in youth, will help to prevent or decrease rates of cannabis-impaired driving in Canada.

- Many people are not aware that cannabis use impairs their ability to drive, that cannabis use can be detected in drivers, and that those caught will be charged just as if they were impaired by alcohol. Greater efforts are needed to ensure that drivers understand the risks of driving after using cannabis.

- To be successful, any approach to reduce cannabis-impaired driving, and cannabis use in general, should be targeted to high-risk groups, such as youth, and will require a combination of research, prevention, enforcement, and treatment and rehabilitation.

Maternal Cannabis Use during Pregnancy — An Update

Definition: *Maternal use* refers to cannabis use during pregnancy and breastfeeding.

Key Findings:

- Cannabis is the most commonly used drug after alcohol during pregnancy.

- Frequent cannabis use during pregnancy is associated with low birth weight and is part of a cluster of risk-factors correlated with other adverse birth outcomes.

- Prenatal and early exposure to cannabis is related to altered neurodevelopment as well as adverse effects on cognition and academic achievement.

- Constituents of cannabis, including cannabinoids (e.g., THC), can pass into breast milk during lactation and they can then be absorbed and metabolized by the infant.

- Long-term effects on behaviour among children and young adults exposed to heavy prenatal cannabis use include attention deficits, increased hyperactivity and impulsivity, and increased likelihood of substance use.

- More research is needed to determine the degree to which cannabinoids, such as THC, affect neurodevelopment, or whether the link between cannabis use and altered infant development is accounted for by other factors (e.g., pre-existing traits of the mother).

Implications:

- Information on the effects of cannabis use during pregnancy and breastfeeding is essential to help healthcare practitioners advise patients about the impact of cannabis use and improve the health and well-being of patients and their children.

- To minimize the harms associated with cannabis use during pregnancy and breastfeeding, health systems and policy must address comorbid risk factors for substance use among women, including social and economic risk factors like poverty and low levels of education.

Respiratory and Cardiovascular Effects of Cannabis Smoking

Definition: The term respiratory effects refers to symptoms or ailments that can affect the lungs. These include chronic obstructive pulmonary disease (COPD), lung cancer and infections of the lower respiratory tract, such as pneumonia. The term cardiovascular effects refers to symptoms or ailments that can affect the heart and blood vessels. These include acute myocardial infarction (heart attack), stroke and arteritis (artery inflammation).

Key Findings:

- THC has the potential to affect blood pressure and heart rate. THC can also make the lungs and airways more susceptible to infections and respiratory problems.

- Individuals who regularly smoke cannabis commonly report coughing on most days, wheezing, sore throat, chest tightness at night, sounds in their chest, early morning phlegm and mucus, and bronchitis.

- More research is needed to determine the impact of regular and heavy cannabis smoking on COPD.

- There is limited evidence for a link between cannabis smoking and heart attack. Evidence for a link between cannabis smoking and stroke and artery inflammation is still unclear. Further studies are required to clarify whether heavy cannabis smoking is a risk factor for the onset of these complications.

- Cannabis smoke contains many of the same toxins and cancer-causing chemicals as tobacco smoke. However, more research is needed to determine whether, and the extent to which, smoking cannabis can increase the risk of lung cancer.

- Cannabis smoking often involves unfiltered smoke, larger puffs, deeper inhalation and longer breath-holding. These practices result in greater exposure to toxins and chemicals, which may provoke greater irritation of lung tissue and cause negative respiratory and cardiovascular effects.

- Vaping unregulated cannabis has been linked with severe lung and pulmonary illnesses.

- Quitting cannabis smoking can reverse some of the negative respiratory symptoms experienced by those who smoke regularly cannabis.

Implications:

- Healthcare practitioners need to be aware of the impact of cannabis smoking on respiratory and cardiovascular health so that they can inform, advise and help their clients make informed decisions about their use of cannabis.

- Effective, evidence-informed initiatives should be implemented to promote knowledge of the respiratory and cardiovascular risks and harms of cannabis smoking, as well as the health benefits of cessation.

- Research is needed to determine the extent to which the use of vaping instruments designed for dried cannabis and extracts, and the chemicals added to cannabis extracts, affect respiratory and cardiovascular health.

Medical Use of Cannabis and Cannabinoids — An Update

Definition: In Canada, cannabis for medical purposes is legally accessed through the *Access to Cannabis for Medical Purposes Regulations*. Authorization for access is provided by healthcare practitioners through a medical document.

Definition: *Cannabinoids* are chemicals found in the cannabis plant. Some of the cannabinoids found in the cannabis plant, such as THC and cannabidiol (CBD), can affect psychological and physiological functions. Cannabinoids can be natural (e.g., THC) or synthetic (i.e., made in a laboratory).

Key Findings:

- Good quality evidence suggests that cannabis and cannabinoids are effective for the relief of nausea and vomiting, certain types of pain, and the stimulation of appetite. However, research to date does not indicate that cannabis and cannabinoids are always the most appropriate drugs to use for these purposes compared to newer pharmaceutical drugs for nausea and pain relief.

- It has been suggested that cannabinoids may be usefully combined with other drugs to provide more effective therapeutic effects.

- There is a lack of research and understanding about the risks associated with the medical use of cannabis. However, reduced cognitive functioning and respiratory harms are associated with chronic use.

- Relative to inhalation, oral administration of cannabinoids, either through capsules or oral sprays, is a less reliable and inconsistent method of drug administration. These factors associated with oral administration make it difficult to determine the appropriate dose for an individual.

- Research is currently examining the potential therapeutic use of cannabinoid products for conditions such as multiple sclerosis, epilepsy, cancer, obesity and glaucoma, and for psychiatric disorders, inflammatory diseases and neurodegenerative disorders. Although findings are mixed, there is promising research emerging for the treatment of some conditions.

Implications:

- Healthcare practitioners need access to the best available scientific evidence to help clients make informed decisions about the use of cannabis and cannabinoids for medical purposes.

- Healthcare practitioners need additional education and training, and practical tools to better treat clients with cannabis for medical purposes.

- There is a pressing need for clinical trials in Canada to examine the effectiveness of cannabis and cannabinoids as therapeutic options for a number of conditions.

- Given the impairing effects of cannabis on driving, healthcare practitioners should advise their patients to refrain from operating a motor vehicle while under the influence of cannabis.

- Future development is likely to be focused on improving the specificity of synthetic cannabinoids and their delivery by safer methods than smoking.

What Role Can You Play in Preventing or Reducing the Negative Effects of Cannabis?

Whether you are a researcher, manager of research funding agency, healthcare practitioner, health promoter, teacher, law enforcement professional, parent or a person who uses cannabis, you have a role to play.

- Take an objective approach, and be informed and aware of the effects of cannabis use.

- Make sure others are aware of the health effects of cannabis and how to lower adverse health outcomes. Be an ally.

- Support research efforts and the development of public education and intervention programs.

For information on edible cannabis and cannabis extracts, visit www.ccsa.ca/research-cannabis and open the New Cannabis Products tab.

For a guide on how to talk to youth about cannabis, check out CCSA's *Talking Pot with Youth* at www.ccsa.ca/talking-pot-youth-cannabis-communication-guide-youth-allies.

About the Clearing the Smoke on Cannabis Series

This series reviews the effects of cannabis use on various aspects of human functioning and development. Each report in the series was prepared and peer reviewed by an expert researcher in the field. The production of the series was made possible through a financial contribution from Health Canada. The views expressed in the reports do not necessarily represent the views of Health Canada.

To explore the full series, open the Health Impacts of Cannabis tab at www.ccsa.ca/research-cannabis.

About CCSA

CCSA is Canada's only agency with a legislated national mandate to reduce the harms of alcohol and other drugs on Canadians. CCSA was created by an Act of Parliament in 1988 to provide national leadership to address substance use in Canada. A trusted counsel, CCSA provides national guidance to decision makers by harnessing the power of research, curating knowledge and bringing together diverse perspectives. CCSA's strategic core functions include providing national leadership, building strategic partnerships, advancing research, and mobilizing knowledge — all with a view to address the harms of alcohol and other drugs on Canadians.

References

Beirness, D.J., & Porath, A.J. (2019). *Clearing the smoke on cannabis: Cannabis use and driving — An update*. Ottawa, Ont.: Canadian Centre on Substance Use and Addiction.

Gabrys, R., & Porath, A.J. (2019). *Clearing the smoke on cannabis: Regular use and cognitive functioning*. Ottawa, Ont.: Canadian Centre on Substance Use and Addiction.

Kalant, H., & Porath-Waller, A.J. (2016). *Clearing the smoke on cannabis: Medical use of cannabis and cannabinoids — An update*. Ottawa, Ont.: Canadian Centre on Substance Abuse.

Konefal, S., Gabrys, R., & Porath, A.J. (2019). *Clearing the smoke on cannabis: Regular use and mental health*. Ottawa, Ont.: Canadian Centre on Substance Use and Addiction.

Renard, J. (2020). *Clearing the smoke on cannabis: Respiratory and cardiovascular effects of cannabis smoking*. Ottawa, Ont.: Canadian Centre on Substance Use and Addiction.

Porath, A.J., Konefal, S., Kent, P. (2019). *Clearing the smoke on cannabis: Maternal cannabis use during pregnancy — An update*. Ottawa, Ont.: Canadian Centre on Substance Use and Addiction.

Statistics Canada (2019). National Cannabis Survey, 3rd quarter 2019. Ottawa, Ont.: Author.