

August 2018

Cannabis & Safety

at home, at work, and on the road

by Maggie Power, MPH(c)



AT HOME • AT WORK • ON THE ROAD

About Safety NL

Newfoundland and Labrador Safety Council, operating as Safety NL, has been providing safety services across the province for over 50 years. They are a non-governmental, not-for-profit organization dedicated to promoting health and safety at home, at work, and on the road.

In the past, Safety NL was best known provincially for its comprehensive motorcycle and driver training programs. That image has been steadily evolving as they innovate in designing and offering certified safety programs that target many facets of the industrial and commercial sector. They are the go-to organization for occupational health and safety training.

In addition, Safety NL offers instruction in a variety of areas in the constantly expanding industrial climate, including forklift operation, powerline hazards, transportation of dangerous goods, and certification for occupational health and safety committees.

Safety NL partners with many community agencies for safety in the community through participation in and support of such initiatives as Students Against Destructive Decision-Making, the Prevent Alcohol and Risk Related Trauma in Youth (P.A.R.T.Y.) program, Lids for Kids Bicycle Helmet Safety program, and Operation Lifesaver.

The Board of Directors is comprised of volunteers dedicated to Safety NL being a trail blazer in the implementation of processes that will cultivate a culture of safety that will permeate the province.

All undertakings of Safety NL are coordinated and monitored by a highly trained and supportive leadership team based at the Mount Pearl office. Delivered by trained staff and certified health and safety practitioners who deliver safety programs to corporations, communities, and individuals throughout our province.

For more information, please contact Safety NL's office or visit their website (listed below).

Safety NL
3 Moffatt Rd
Mount Pearl, NL A1N 5B9

Phone: (709) 754-0210
Toll free: 1 (877) 754-0210

E-mail: info@safetyservicesnl.ca
Fax: (709) 754-0010

www.safetynl.ca

Executive Summary

Objective: To investigate how cannabis legalization may impact health and safety at home, at work, and on the road in the province of Newfoundland and Labrador.

Methodology: Completion of literature searches, bibliographic searches, exploration of grey literature, and jurisdictional analysis of states where legalization is already in effect.

Results: **AT HOME** Cannabis legalization led to an increase in unintentional pediatric cannabis exposures, pet cannabis exposures (particularly dogs), increased explosions and burns due to processing of cannabis concentrates, and fires from indoor grow operations. Recommendations are provided for proper storage, home cultivation, use at home, and harm reduction. **AT WORK** It is unclear as to the impact that legalization will have in the workplace, as good quality studies are lacking and cannabis use is already prevalent. Recommendations are provided for substance use policies, preventing cannabis use, and dealing with medical cannabis in the workplace. **ON THE ROAD** Cannabis use affects cognitive functions necessary for driving. Driving after cannabis use is associated with increased risk of motor vehicle accidents and culpability. Cannabis combined with alcohol leads to severe impairment and elevated risk of a motor vehicle accident. Recommendations are provided for wait times before driving after cannabis use.

Conclusions: Cannabis legalization will likely have at least some effect on safety at home, at work, and on the road. However, cannabis is already being consumed by Canadians, and it is not clear by what magnitude consumption will increase. More research is needed in many areas, especially on the impact to workplace safety.

100 Day Countdown to Legalization

On July 9th, 2018, Safety NL launched a social media campaign on [Facebook](#) and [Twitter](#) in an effort to communicate the content of this document to the general public. In the 100 days prior to cannabis legalization, a daily cannabis safety fact was posted to Safety NL's social media accounts. A document including all 100 posts will be available once cannabis legalization comes into effect on October 17th, 2018.

Table of Contents

Background	4
What is cannabis?.....	5
Cannabinoids and the Endocannabinoid System.....	5
Methods of Consumption	6
Cannabis Use in Canada	7
Cannabis Legislation in Canada	8
Cannabis on the Road	10
Trends in Driving after Cannabis Use	10
Effects on Driving.....	11
Cannabis and Alcohol	13
Risks Related to Driving after Cannabis Use (DACU)	14
Detecting Cannabis-Related Impairment.....	15
Medical Cannabis and Driving	16
Impact of Legalization on Road Safety.....	17
Summary	18
Cannabis at Work.....	19
Prevalence of Cannabis Use in the Workplace	19
Impact of Cannabis on Occupational Injury	19
Legislative Requirements.....	20
Mitigating Workplace Cannabis Use.....	21
Detecting and Responding to Impairment	22
Medical Cannabis in the Workplace	24
Summary	24
Cannabis at Home	26
Unintentional Exposures.....	26
Cannabis Use	27
Home Cultivation.....	28
Solvent Extraction	30
Harm Reduction	31
Summary	33
Conclusion	34

Summary of Recommendations	35
Additional Resources	37
Appendix A: Sample Workplace Substance Use Policy	38
Appendix B: Sample Workplace Accommodation Policy	40
References	45

Background

What is cannabis?

Cannabis refers to the *Cannabis sativa* L. plant (*C. sativa*). There are different preparations of cannabis, including but not limited to fresh or dried herbal material, physically concentrated extracts (e.g. hashish, kief), chemically concentrated extracts (e.g. hash oil, shatter, wax), tinctures, and oils. The *C. sativa* plant originated in Asia, but is now grown all over the world, including in Canada. Cannabis has a long history of use by humans for fiber (hemp), seed oils, seeds, medical treatment, and recreation.¹ Some commonly used terms for cannabis include marijuana, weed, pot, dope, ganja, green, grass, chronic, reefer, skunk, and Mary Jane.

Marijuana is the most commonly used term by the public, but technically this is a colloquial term referring to the dried flowers and leaves of the *C. sativa* plant. For the purposes of this document, cannabis will refer to all preparations of the *C. sativa* plant.

Cannabinoids and the Endocannabinoid System

Cannabis contains hundreds of chemical substances, over 100 of which are cannabinoids, a class of chemical which acts on the endocannabinoid system in the body.² This system plays an important role in a number of bodily processes such as metabolic regulation, craving, pain, anxiety, bone growth, and immune function,³ and helps to regulate the body's drive to "relax, eat, sleep, forget, and protect."⁴ Phytocannabinoids (the cannabinoids that naturally occur in the cannabis plant) bind to CB1 and CB2 receptors in the endocannabinoid system. CB1 receptors are found primarily in the brain and in several peripheral tissues, whereas CB2 receptors are found mostly in the immune system and hematopoietic cells.⁵ The human body produces its own endogenous cannabinoids, such as anandamide.

Two main cannabinoids which are found in cannabis are Δ^9 -tetrahydrocannabinol (THC) and cannabidiol (CBD). THC is the primary psychoactive compound responsible for the "high" an individual may feel after consuming cannabis.⁶ Acute psychological effects of THC include euphoria, relaxation, dysphoria, sedation, and altered perception, and the intensity of these effects increases with higher doses.⁷ Physiologically, THC can cause increased heart rate and blood pressure, increased appetite, dilated pupils, reddened conjunctiva (eyes), dry mouth and throat, body and eyelid tremors, and bronchodilation (expansion of the breathing passages).^{8,9} THC also has therapeutic properties and is used primarily in the treatment of chemotherapy-induced nausea and appetite or weight loss in AIDS patients.¹⁰

Unlike THC, CBD is not psychoactive and may actually act as an antagonist to the effects of THC.^{11,12} CBD has shown to have neuroprotective, antiepileptic, anxiolyticⁱ, antipsychotic, analgesicⁱⁱ, anti-inflammatory, and antitumor properties.^{13,14} Concentrated CBD oil can be used as an anti-seizure medication to treat intractable child epilepsy, like Dravet and Lennox-Gastaut syndromes.¹⁰ Medications composed of CBD and THC in a 1:1 ratio are

ⁱ Used to reduce anxiety

ⁱⁱ Used to relieve pain

used to relieve neuropathic pain and spasticity associated with multiple sclerosis, and as an analgesic treatment in cancer patients.¹⁵

Another common cannabinoid found in cannabis is cannabitol (CBN), a degradation product of THC that presents when THC is heated or exposed to oxygen.¹⁶ CBN is most commonly found in aged or improperly stored cannabis products.¹⁷ CBN can be either non-psychoactive or very mildly psychoactive,¹⁸ however it can elevate the effects of THC.¹⁹ CBN is a strong sedative and has a synergistic effect with the sedative properties of THC and CBD.¹⁸

It is important to note that cannabinoids like THC can only be extracted from cannabis through decarboxylation, which is a process that can occur readily over time or through heating.²⁰ In other words, if an individual were to consume unaltered cannabis material (like dried flowers or buds), no psychoactive effects would be experienced as decarboxylation has not occurred.

Methods of Consumption

Cannabis can be consumed through inhalation or ingestion using a variety of methods. Notably, the mode of administration can affect the onset and duration of effects.

Cannabis can be inhaled through smoking or vaporization. Smoking is the most common method of consuming cannabis among Canadians.²¹ When inhaled, effects are perceptible within seconds and come into full effect within a few minutes,²² and subside after 3–4 hours.²⁰ Some common devices used to smoke cannabis include:

Joints: cannabis rolled in a paper, much like a cigarette. The paper can be made of rice, bamboo, hemp, or other materials. A typical joint contains around 0.3 grams of cannabis.²³

Blunts: cannabis rolled in a tobacco leaf or paper, or in a hollowed-out cigar.

Spliffs: cannabis and tobacco rolled together in a paper.

Pipes: consists of a narrow tube with a bowl at one end in which to place the cannabis material and a mouthpiece on the other to inhale the smoke produced. Pipes can be made from glass, wood, ceramic, clay, or other materials.

Water pipes: pipes containing water through which the smoke passes before it is inhaled. Water pipes can come in different variations, such as bongs and bubblers.

Cannabis can also be inhaled through vaporization. Vapourizers heat the cannabis to a temperature where cannabinoids can be released into a vapour and inhaled by the consumer. Vapourization reduces the toxic compound intake associated with inhaling combusted cannabis as it does not heat the material to the point of combustion, as is done by smoking.²⁴

Additionally, cannabis concentrates (e.g. shatter, budder, wax, butane hash oil) can be inhaled through a process known as dabbing. Dabbing involves heating the concentrate on a

hot surface, usually a nail that is heated by a torch, and then inhaling the vapour through a “dab rig,” which is quite similar to a water pipe.

Oral consumption of cannabis delays the onset of effects when compared to inhalation and also prolongs them. This is because the cannabis product must be processed through the liver before it enters the bloodstream. Psychotropic effects can be felt within 30–90 minutes of consumption and usually last for about 6–8 hours,²⁵ and the presence or absence of food in the stomach as well as an individual’s metabolism can affect the onset of effects.²⁶ Cannabis can be ingested in the form of edibles, tinctures, or oils.

Edibles are food or beverage products which have been infused with cannabis, such as brownies, cookies, candies, or butters. An individual can add cannabis directly to food before cooking it, or use cannabis-infused butter or infused cooking oil.

A tincture is produced by dissolving a cannabis extract in a solvent, typically alcohol or glycerin.²⁷ Tinctures are applied sublingually (i.e. under the tongue) or can be added to foods or beverages to be consumed orally. The onset and duration of effects associated with sublingual administration differ from oral administration, with effects being felt 5–30 minutes after sublingual administration and lasting for 2–4 hours, but this can vary depending on the dose.²⁸

Oils can be used sublingually or orally. Some common oils include CO₂ oil, which is made using a process known as supercritical fluid extraction (using pressure and a fluid, in this case carbon dioxide, to separate cannabis plant material), and Rick Simpson oil (RSO), which is made by soaking cannabis in isopropyl alcohol.

Refer to Table 1 for a summary of various cannabis consumption methods and their associated onset and duration of effects.

Table 1: Consumption methods and associated onset and duration of effects

Method	Onset of effects	Duration of effects
Inhalation: <ul style="list-style-type: none"> ▪ Smoking ▪ Vaporizing ▪ Dabbing 	A few seconds to minutes	3–4 hours
Oral: <ul style="list-style-type: none"> ▪ Edibles ▪ Oils ▪ Tinctures 	30–90 minutes	6–8 hours
Sublingual: <ul style="list-style-type: none"> ▪ Tinctures ▪ Oils 	5–30 minutes	2–4 hours

Cannabis Use in Canada

Canada’s prevalence of past-year cannabis use in 2016 was one of the highest in the world.²⁹ Cannabis is the most commonly used illicit drug in Canada, and next to alcohol it is the most commonly used substance overall.³⁰ According to the National Cannabis Survey

(first quarter, 2018), 14% of Canadians aged 15 years and older reported having used cannabis for medical or non-medical purposes within the past three months.³¹ Over half (56%) of users reported using cannabis weekly or daily within the past three months, and males (16%) were more likely than females (12%) to report use.³¹

Prevalence of cannabis use decreases with age. 22% of individuals aged 15–44 reported use within the past three months, compared with 7% of those aged 45 years and older.³¹ More than one in four Canadians aged 25 to 34 reported some use of cannabis within the past three months, and over one in five Canadians aged 15 to 24 reported the same.³¹ One in four of Canadian adults had tried cannabis by the time they were 18,³² with the average age of initiation of use being 18.7 years.²¹

In terms of frequency of use, 40% of users reported using cannabis daily, whereas 30% only used it once or twice in the past three months. The remaining groups were weekly (17%) and monthly (14%) consumers.³¹ The most commonly used product was dried flowers (78%), followed by edibles (28%) and hashish (11%),³¹ and the most common method of consumption was smoking (94%).²¹

Socioeconomic factors that influence cannabis use patterns include education level, employment status, and income. Canadians with less than a high school education were significantly less likely to have used cannabis within the past month when compared to those with a high school education or non-university postsecondary diploma.³² Students were less likely to have used cannabis within the past month than those who were employed.³² Canadians living in a household with an income of \$40,000 or less were more likely to report using cannabis within the past month, and also were more likely to use 2 to 6 times a week.³² Additionally, the married/common law population were significantly less likely to report past-month use when compared to the single, never married population.³²

According to the 2017 Canadian Cannabis Survey, 12% of respondents indicated they had used cannabis for medical purposes within the past 12 months, however 71% of these respondents did not have an appropriate medical document from a health care professional authorizing this use (i.e. self-medicating).²¹ The most common products used for medical purposes were dried flower/leaf (81%) and edibles (30%).²¹

Cannabis Legislation in Canada

Cannabis prohibition has been in effect in Canada since 1923 when it was added to the list of prohibited drugs in the *Opium and Drug Act*. Cannabis is listed as a Schedule II drug under the *Controlled Drug and Substances Act* until the *Cannabis Act* comes into effect in October 2018, meaning that growing, possessing, distributing, or selling cannabis is subject to offences under that Act.

Medical use of cannabis is regulated under the *Access to Cannabis for Medical Purposes Regulations* (ACMPR). ACMPR came into effect in 2016, replacing the *Marihuana for Medical Purposes Regulations* (MMPR). The ACMPR allow for reasonable access to cannabis for medical purposes for Canadians who have been authorized to use cannabis for medical purposes by their health care practitioner.³³ The ACMPR allows Canadians who use

cannabis for medical purposes to produce a limited amount of cannabis themselves or designate someone to produce it for them, and to purchase quality-controlled cannabis from a Health Canada licensed producer.

Bill C-45, the *Cannabis Act*, was introduced to the House of Commons in April of 2017 and will come into effect on October 17, 2018. The *Cannabis Act* will create a strict legal framework for controlling the production, distribution, sale, and possession of cannabis across Canada. The Act seeks to³⁴:

- Restrict youth access to cannabis;
- Protect young persons by prohibiting promotion or enticements to use cannabis;
- Enhance public awareness of the health risks associated with cannabis use;
- Deter and reduce criminal activity by imposing serious criminal penalties for those breaking the law, especially those who provide cannabis to young persons;
- Protect public health through strict product safety and quality requirements;
- Provide for the legal production of cannabis to reduce illegal activities;
- Allow adults to possess and access regulated, quality-controlled, legal cannabis; and
- Reduce the burden on the criminal justice system.

Bill C-46 was also proposed and passed as law in June 2018, which amends the *Criminal Code* to strengthen drug and alcohol-impaired driving laws. The Bill introduced three new offences for having specified levels of a drug in the blood within two hours of driving. For example, the specified blood concentrations and their associated offences for THC are³⁵:

- 2 nanograms (ng) but less than 5 ng of THC: summary conviction offence, maximum fine of \$1000
- 5 ng or more of THC: hybrid offence
- 2.5 ng of THC combined with 0.05% blood alcohol concentration: hybrid offence

Both hybrid offences are punishable by mandatory penalties of \$1000 for a first offence, 30 days imprisonment for a second, and 120 days imprisonment for a third offence. Bill C-46 also authorizes police officers to use oral fluid screening devices for roadside drug testing.³⁵

Newfoundland and Labrador Legislation

In the province of Newfoundland and Labrador (NL), the legal age to purchase and possess cannabis will be 19 years of age. Use of cannabis will be limited to private residences only, and retail sales of cannabis will be overseen by the Newfoundland and Labrador Liquor Corporation and delivered by private retailers.³⁶ Individuals will be permitted to grow up to four (4) cannabis plants per residence.³⁷

Drug-impaired driving laws in NL will include a zero tolerance policy for novice drivers, drivers under the age of 22, and commercial drivers. The presence of drugs or drugs combined with alcohol in a driver of one of these categories will result in a seven day vehicle impoundment. All drivers deemed impaired by the Standardized Field Sobriety Test (SFST)/approved screening device and/or Drug Recognition Expert (DRE) (see **Detecting Cannabis-Related Impairment**) will also be subject to a seven day vehicle impoundment.³⁸

Cannabis on the Road

Trends in Driving after Cannabis Use

Driving after using cannabis has shown to be a common practice in Canada. According to the 2017 Canadian Cannabis Survey, 39% of individuals who had used cannabis in the past 12 months self-reported operating a motor vehicle within 2 hours of using cannabis, and 40% of these individuals reported doing so in the last 30 days.²¹ The National Cannabis Survey (1st quarter, 2018) found that those who used cannabis daily or weekly were more likely to report driving within 2 hours of consumption.³¹ Males were more likely to report driving within 2 hours of use than females.²¹ Of those that reported driving within two hours of using cannabis, almost half reported doing so 1 to 10 times in the past 12 months, and nearly 30% reported doing so over 10 times in the past 12 months.²¹ In addition, 15% of respondents reported driving within two hours of consuming cannabis in combination with alcohol.²¹

Canadians who reported using cannabis for medical purposes in the past 12 months on the Canadian Cannabis Survey were also likely to report driving after using cannabis – 37% of these respondents reported driving within 2 hours of use, and half of those reported doing so in the past 30 days.²¹ One quarter of respondents who had used cannabis for medical purposes in the past 12 months reported driving within 2 hours of use over 10 times in the past 30 days.²¹ 10% of individuals using cannabis for medical purposes reported driving within 2 hours of using cannabis in combination with alcohol.²¹

In addition to self-reported studies about driving after cannabis use, a number of roadside surveys have been conducted as well. In British Columbia, roadside surveys took place in 2008, 2010, and 2012, where randomly selected drivers were asked to provide oral fluid and breath samples in order to detect the presence of drugs and alcohol. In the 2010 survey, 4.5% of individuals who agreed to provide oral fluid samples tested positive for THC, making cannabis the most commonly detected drug in the study.³⁹ Cannabis was the most frequently detected drug in the 2012 survey as well, accounting for 43.6% of the drugs detected.⁴⁰

Riding as a passenger with a driver who had recently consumed cannabis is also a common practice in Canada and was reported by 39% of all respondents in the Canadian Cannabis Survey.²¹ This behaviour was more common among people who use cannabis (use within the past 12 months; 79%) than non-users (27%).²¹ According to the Canadian Student Tobacco, Alcohol and Drugs Survey, nearly 20% of grade 9–12 students had been a passenger in a vehicle driven by someone who had recently consumed cannabis – 9% had within the past 30 days.⁴¹

Cannabinoids are commonly found in drivers involved in motor vehicle accidents. A study of seriously injured drivers admitted to a regional trauma unit in Toronto found that 13.9% tested positive for cannabinoids,⁴² and another study found that, along with central nervous system depressants, cannabis was the most commonly found drug in fatally-injured

drivers.⁴³ It is important to note these studies indicate the presence of cannabinoids in drivers involved in collisions but do not address impairment caused by cannabis.

In terms of perceptions surrounding cannabis and its influence on driving, 75% of all respondents in the Canadian Cannabis Survey believed that cannabis had some effect on driving capabilities.²¹ This percentage drops to 50% when looking at responses from those who had used cannabis in the past 12 months.²¹ Almost one in five people who have used cannabis in the past year believe that cannabis use does not have any effect on driving.²¹

Effects on Driving

Experimental studies have shown that doses of THC between 40 and 300µg/kg cause a dose-dependent reduction in performance in laboratory tasks which measure the following cognitive and psychomotor functions^{7,44-48}:

- memory
- reaction time
- sustained and divided attention
- motor function
- tracking
- spatial and temporal perception

Driving simulator and on-road studies examine how these cognitive and psychomotor impairments can affect driving capabilities. THC has shown to have the greatest effect on divided attention tasks (performing ≥ 2 subtasks simultaneously), unexpected events or choices, and long, monotonous drives.⁴⁹ Impairments from THC increase with task complexity.⁴⁹

A common index used in driving simulator and on-road studies to measure THC impairment is Standard Deviation of Lateral Position (SDLP). This is one of the most sensitive road-tracking measures for revealing THC impairment,⁵⁰ and refers to the ability to maintain lateral road position in one's lane (i.e. no weaving). Drivers under the influence of cannabis are unable to compensate for SDLP,⁵¹ and increasing doses of THC will increase SDLP.⁵²⁻⁵⁵

THC impairment can also be observed in other aspects of driving, like following distance, speed, steering wheel variability, and braking. A number of studies show that 13–38mg of smoked THC can cause a dose-related increase in average following distance (the distance between the preceding vehicle and the driver's vehicle),^{52,54} variability in following distance,^{53,54} and decrease in average speed.^{54,56-58} Increased steering wheel variability was observed in some studies,^{54,56} as well as braking latency,⁵⁶ likely due to THC's effect on reaction time.

Less is known about the possible impairing effects of a 'weed hangover' or 'burnout.' Subjective reports of hangover symptoms the day following cannabis use include lack of saliva, feeling fatigued, having brain fog, nausea, and dry or red eyes.⁵⁹ Limited studies have investigated residual effects of cannabis the following day, but two studies described minimal residual performance effects.^{60,61} The Canadian Public Health Association suggests that a 'weed hangover' may be related to overconsumption.⁵⁹

Long-term use of cannabis can have lasting effects on the brain. Long-term effects on executive functions that are required for safe driving are related to duration of use (i.e. the longer an individual regularly uses cannabis, the more likely they are to experience long-term cognitive effects).⁶² Some research shows that cognitive effects improve after discontinuation of use,⁶³ but other studies show persistent deficits in decision making, concept formation, planning,⁶⁴ attention, and concentration.^{65,66} Regular cannabis use can cause structural changes to areas of the brain that are functionally associated with motivational, emotional, and affective processing,⁶⁷ and alterations in these brain areas may influence driving habits and skills.⁶⁸

Drivers under the influence of cannabis tend to perceive their driving as impaired and more cautious.⁶⁹ They seem to be aware of cannabis-related impairments and attempt to compensate by driving more cautiously or renouncing to drive.^{51,54,56,58} Drivers may reduce their speed, increase following distance, and make fewer attempts to overtake a preceding vehicle to compensate for perceived impairment.^{51,70}

A number of factors determine the degree of impairment that an individual will experience from consuming cannabis. These include:

- THC concentration
- User experience
- Mode of administration
- Smoking topography (if inhaled)
- Use with other substances

As mentioned above, THC has a dose-dependent relationship with impairment – generally, the degree of impairment increases with higher doses.⁷¹ Thus, consuming cannabis products with higher THC concentrations will likely result in a greater magnitude of impairment. However, there is some variability among individuals as to how a certain dose of THC will affect them. This can be influenced by a user's experience with cannabis.

Frequent cannabis consumption can lead to the development of tolerance to the drug. This means that greater amounts of THC are required to induce the same effects – in turn, user experience with cannabis can alter the degree of impairment experienced. A number of studies have shown that infrequent users of cannabis are more likely to display a greater magnitude of impairment than frequent users after consuming the same dose of THC.⁷²⁻⁷⁵ This evidence includes both laboratory cognitive tests and on-road studies. For example, one study examined the performance of people who use cannabis occasionally (weekly or less) and heavily (>4 days a week) in a series of laboratory tasks testing for impairment of divided attention, tracking, and reaction time.⁷⁵ After inhaling the same dose of THC, occasional users experienced impairment in all three tasks, whereas heavy users experienced no impairment in two out of three tasks.

How an individual chooses to consume cannabis will affect the onset of psychoactive effects, and it may influence the degree of impairment as well. As mentioned in **Methods of Consumption**, oral consumption of cannabis creates the greatest delay before effects can be

felt – about 30 to 90 minutes after ingestion. Oral consumption also differs from inhalation and sublingual administration in that Δ^9 -THC has to first pass through the liver, leading to the production of THC metabolites. One metabolite, 11-hydroxy-THC, is psychoactive and one study found it to be 3 to 7 times more potent than Δ^9 -THC.⁷⁶

Research suggests that the ratio of Δ^9 -THC and 11-hydroxy-THC in a user's system might impact the intensity of the psychological high experienced. Ingesting cannabis produces equal blood concentrations of Δ^9 -THC and 11-hydroxy-THC, whereas inhalation leads to Δ^9 -THC levels that are 10 times that of 11-hydroxy-THC.⁷⁷ However, ingesting cannabis results in less bioavailabilityⁱⁱⁱ of Δ^9 -THC because of the way it is metabolized through the digestive system.²⁰ It has been suggested that the higher levels of 11-hydroxy-THC may counteract the low bioavailability of Δ^9 -THC when consuming orally. Many users report experiencing a greater subjective high from oral consumption of cannabis, and this could be due to the increased amounts of 11-hydroxy-THC, but this claim cannot be supported or refuted using existing evidence.

Bioavailability of THC can be maximized through smoking topography (i.e. how a person smokes). Factors influencing this include the depth of inhalation, puff duration, and breath hold.²⁰ Heavy users display about 50–70% greater bioavailability of THC compared to occasional users due to more efficient inhalation by manipulating the aforementioned factors.²⁰ A greater bioavailability of THC will likely lead to a greater degree of impairment.

An important consideration when examining cannabis and its effect on driving is the common practice of using cannabis with other substances. While evidence examining polydrug use with cannabis is limited, it is generally reported that using a combination of two or more drugs can significantly increase an individual's risk of being involved in a road traffic accident.⁷⁸ However, cannabis in combination with alcohol can increase the impairing effects of cannabis, and this has been studied extensively.

It is recommended that individuals wait at least 6 hours after inhaling and 8 hours after ingesting cannabis before driving a motor vehicle to ensure that all impairing effects of THC have subsided.⁷⁹ Individuals should wait even longer before driving if they are still experiencing the euphoric effects of THC.

Cannabis and Alcohol

Many studies and reviews have found that combining THC and alcohol, even at small doses, can significantly increase impairment. This increase appears to be at least additive in nature,^{52,71} meaning the combined effect of THC and alcohol is equal to the sum of their individual effects. Some studies have found their combined effects to be synergistic (their combined effect is greater than the sum of their separate effects).^{53,57,80} Nevertheless, combining alcohol and THC causes “severe impairment of cognitive, psychomotor, and actual driving performance.”⁷¹

ⁱⁱⁱ Bioavailability refers to the proportion of a drug that enters circulation once introduced into the body and is able to have an active effect.

Respondents of the Canadian Cannabis Survey who had driven within two hours of using cannabis were asked if they had ever done so in combination with alcohol. Of those respondents, 15% reported this practice.²¹ Further, 10% of respondents who had used cannabis for medical purposes in the past 12 months reported the same.²¹ A study of 322 motor vehicle accident victims found that 30% of the THC-positive individuals had also been drinking alcohol.⁸¹

Co-administration of THC and alcohol results in higher blood concentrations of THC when compared to the same dose taken without alcohol.⁸⁰ This could be why effects are amplified when the substances are used in combination. Impairment results from doses of each drug that would be insignificant if taken separately.⁸²

Alcohol may impede an individual's ability to compensate for cannabis impairment as described above using techniques like reducing speed and increasing following distance.⁵¹ Cannabis causes greater impairment of automated tasks related to driving, whereas alcohol causes greater impairment to consciously performed tasks.⁸² Consuming THC and alcohol concomitantly eliminates the ability to use compensation strategies effectively. Additionally, individuals are likely to consume greater quantities of alcohol when used concurrently with cannabis, further increasing impairment.⁸³

Epidemiological studies have found that people who drive after using cannabis and alcohol concurrently have a greater risk of being involved in a road traffic crash and an increased risk of being found responsible for an accident. This is discussed further in the following section.

Risks Related to Driving after Cannabis Use (DACU)

Driving after cannabis use (DACU) increases the risk of being involved in a motor vehicle accident. The evidence is mixed on the magnitude of increased risk, but there is consensus that recent cannabis use is related to increased risk of a motor vehicle accident. The most common measure used to communicate risk in epidemiological studies is the odds ratio (OR). An OR of 1 would mean that there is no increased risk of a motor vehicle accident for DACU versus without having used cannabis. An OR of 3 would mean that risk of an accident is 3 times higher for DACU.

A recent review found that 20–30% of traffic crashes involving cannabis occurred because of the cannabis use.⁸⁴ The review found that driving after cannabis use increases crash risk (OR=1.22) by a low to medium magnitude – a risk comparable to that of driving with a blood-alcohol content of 0.04–0.05.⁸⁵ Other studies have reported similar magnitudes of risk. One study found that DACU was associated with an increased risk of motor vehicle accidents when compared to individuals who had never driven after cannabis use (OR=1.84).⁸⁶

Some studies measure the risk of being found responsible for a road traffic crash and its correlation with DACU. These are referred to as culpability studies. A 2004 review found that drivers with measurable THC blood concentrations were 3 to 7 times more likely to be responsible for an accident compared to drivers with no drugs or alcohol in their system.⁷¹

Drummer et al⁸⁷ reported higher odds of culpability for drivers with THC in their system when compared to drug-free drivers (OR=2.7), and these odds increased and became more statistically significant with increased blood concentrations of THC (the OR increased to 6.6 for drivers with THC blood concentrations of 5ng/mL or higher). However, other studies have found no significant increase in culpability associated with cannabis use.^{88,89}

While driving after cannabis use moderately increases the risk of motor vehicle accident involvement, driving after consuming both THC and alcohol further increases this risk due to the additive effect of combining these substances. In one French study of fatally injured drivers, THC-positive drivers (blood concentration of ≥ 1 ng/mL) were 2.3 times more likely to be culpable when compared to drivers with no drugs or alcohol in their system.⁹⁰ Drivers who had consumed only alcohol (BAC ≥ 0.05) were 9.4 times more likely to be culpable for the crash, and drivers with a combination of alcohol and cannabis in their systems were 14.1 times more likely to be responsible for an accident.⁹⁰ Driving after cannabis use is also more common among people who also drive after drinking alcohol.⁸⁶

Detecting Cannabis-Related Impairment

Detection of cannabis-related impairment can be conducted through observational and biological testing methods. Observational testing methods include the Standardized Field Sobriety Test (SFST) and Drug Recognition Expert (DRE) evaluations, and biological methods include testing for the presence of THC in blood, urine, or saliva.

The Standardized Field Sobriety Test (SFST) is administered roadside by a police officer should an individual be suspected of driving while impaired. Police officers may suspect cannabis impairment through observed driving behaviours, physiological characteristics like reddened conjunctiva and dilated pupils, lapses in attention and concentration, or a cannabis odour.⁸ The SFST consists of three observational tests: Horizontal Gaze Nystagmus (involuntary jerking of the eyes), Walk and Turn, and One Leg Stand. If an individual shows impairment on at least two of three of these tests, then an evaluation is conducted with a Drug Recognition Expert (DRE). These are specially trained police officers who are able to detect which class of drug may be causing impairment. The DRE evaluation is a 12 step process which utilizes a combination of observational and physiological measures to detect impairment, like blood pressure, pulse, and temperature readings, eye examinations, and additional divided attention tests like those employed in the roadside SFST.⁹¹ The DRE evaluation is further supported by a biological testing method, typically a blood test.

Blood testing involves measuring concentrations of THC in whole blood, or plasma/serum. Plasma is the liquid component of blood, and serum is the liquid component with coagulation (clotting) factors removed. Plasma and serum concentrations of THC are about 2 times that of whole blood.⁹² Evidence suggests that THC concentrations of 2–5ng/mL in whole blood (7–10ng/mL in serum) lead to substantial impairment (equivalent to a blood alcohol concentration of 0.05%), especially in people who use cannabis occasionally.⁴⁹ The federal government has set these levels as *per se* limits for drug-impaired driving penalties (see **Cannabis Legislation in Canada**). This includes a margin of error to prevent “misclassification of drivers presenting with THC residues from previous cannabis use” and

to "spare drivers with low but measurable THC concentrations caused by passive exposure [second-hand smoke]... or oral intake of low THC doses for medicinal purposes."⁹³

It is important to note that plasma concentrations of THC do not exactly correlate with psychotropic effects. Following inhalation, THC concentrations in the blood have already dropped significantly before maximal psychotropic effects are achieved.²⁰ Plasma concentrations of THC reach their peak about 3–10 minutes after smoking and then rapidly decline, while peak psychotropic effects occur 20–30 minutes after inhalation.²⁰ However, plasma concentrations do seem to correlate well with effects around 1–4 hours after inhalation.²⁰ Maximal psychotropic effects after oral administration are also reached after plasma concentrations have begun to decline.²⁰

Oral fluid testing is a less invasive way to test for the presence of THC in a driver, and would be especially convenient for use as a roadside screening test. Research shows that THC concentrations in saliva appear to correlate reasonably well with plasma concentrations.⁹³ However, extrapolating plasma concentrations of THC from oral fluid concentrations cannot be scientifically supported as the ratio is highly disputed among researchers. For example, a 2004 study by Huestis and Cone found a ratio between 1 and 2 – that is, if the plasma concentration was 5 ng/mL, the oral fluid (OF) concentration would be reported between 5–10 ng/mL.⁹⁴ Another study by Ramaekers et al⁴⁸ found a markedly different ratio, with OF concentrations around 10–30 times higher than plasma concentrations. Researchers have also found a high degree of inter-individual variability with these ratios.⁹⁵

Urine can be used as a screening method for detection of THC, but urine testing is not a practical option for roadside administration. Additionally, urine tests detect THC metabolites which may not signify recent use of the drug, as these metabolites can persist in the urine long after the active drug has been eliminated from the body.⁹⁶ Cannabinoids are extremely lipid soluble, meaning they accumulate in fatty tissues in the body. They reach peak concentrations in fatty tissues within 4–5 days after consumption and are then slowly released back into other compartments of the body.²² Complete elimination of a single dose from one's system may take up to 30 days because of this property.⁹⁷ With repeated dosage, high levels of cannabinoids can accumulate in the body.²²

An example of a persisting THC metabolite is 11-nor-9-carboxy-THC (THCCOOH), which is non-psychoactive and remains present in the urine for relatively long periods of time – up to several months in formerly heavy consumers of cannabis.⁹⁸ This metabolite remains present in blood plasma for several days in occasional users and weeks in more chronic consumers.⁹⁸ Detection of this metabolite is not indicative of cannabis impairment.

Medical Cannabis and Driving

Recreational cannabis and cannabis use for medical purposes are distinguishable in their effect on driving for a number of reasons. Firstly, chronic illnesses that may be treated with cannabis have been shown to increase the risk of motor vehicle accidents. A 2010 study found that certain impairing illnesses, such as dementia, epilepsy, multiple sclerosis, psychiatric disorders, schizophrenia, sleep apnea, and cataracts at least doubled ($OR \geq 2$) the risk of a motor vehicle accident.⁹⁹ Some of these illnesses can be treated with cannabis. It is

worth noting that these odds are higher than those reported by Mann et al⁸⁶ for the association between driving after cannabis use and motor vehicle accidents (OR=1.84).

Most patients use cannabis therapeutically to treat the symptoms of their illness, not to achieve psychoactive effects. Health Canada indicates that “doses of THC as low as 2.5–3 mg of THC (and even lower) are associated with a therapeutic benefit and minimal psychoactivity.”¹⁰⁰ Furthermore, users could develop a tolerance to THC, meaning that its impairing effects may be significantly reduced as the individual continues to use the substance.

Finally, CBD, another cannabinoid that is non-intoxicating, is much more commonly found in medical cannabis strains than recreational ones. CBD has been shown to have neuroprotective, antiepileptic, anxiolytic, antipsychotic, analgesic, anti-inflammatory, and antitumor properties, and can be used to treat a variety of symptoms.^{13,14} CBD may actually counteract the effects of THC when present in high quantities.⁷⁹ Thus, a user can consume a CBD-dominant variety of cannabis and may feel no impairment. Products with only CBD are also available, which would not cause any impairment to a consumer.

Users of cannabis for medical purposes are encouraged to discuss their medication and its effect on driving with their physician or medical professional. Newfoundland and Labrador’s impaired driving laws include medical exemption provisions, so long as legal authorization to use cannabis is provided and the individual is not impaired.³⁸

Impact of Legalization on Road Safety

Eight U.S. states and the District of Columbia have legalized recreational cannabis, as has Uruguay, a small country in South America. Legalization of cannabis for non-medical purposes in Canada will be contextually different from these jurisdictions, as Canada is a G7 country and legalization will occur on a national scale unlike the process in the United States where the use of recreational cannabis is still illegal under federal law. Data from these jurisdictions can still prove to be useful in terms of what we can expect when Bill C-45, the *Cannabis Act*, comes into effect in Fall 2018.

The state of Washington legalized recreational cannabis in December 2012. One study examined the amount of THC-positive drivers involved in fatal crashes from 2010 to 2014 in that state.¹⁰¹ The authors found that the prevalence of THC-positive drivers started to increase about 9 months after legalization. In 2013, there were 49 drivers with detectable THC concentrations in their blood (8.3% of all drivers involved in fatal crashes). In 2014, this number doubled – 106 drivers were THC-positive, accounting for 17% of all drivers involved in fatal crashes. The authors do note that it is unclear if this increase was attributable to legalization, and also that the presence of THC does not necessarily mean the driver was impaired or at fault for the crash.

Santaella-Tenorio et al¹⁰² found that the presence of medical cannabis laws reduced traffic fatalities, especially in those aged 25–44 years. This study looked at traffic fatalities from 1985 to 2014 in relation to the enactment of medical cannabis laws. They found a decrease in traffic fatalities in states post-medical cannabis legalization, and that states with legal

medical cannabis had lower traffic fatalities than states where medical cannabis remained illegal. The authors suggested this could be due to a reduction in alcohol-impaired driving, which is supported by the substitution hypothesis. The substitution hypothesis refers to “the conscious choice to use one drug (legal or illicit) instead of, or in conjunction with, another due to issues such as: perceived safety; level of addiction potential; effectiveness in relieving symptoms; access and level of acceptance.”¹⁰³ This could prove to be relevant in the wake of non-medical cannabis legalization in Canada.

Related to the above mentioned study, Kim et al¹⁰⁴ examined the relationship between medical cannabis laws and opioid positivity in fatally injured drivers. This study found that operational medical cannabis laws were associated with a decrease in opioid positivity in fatally injured drivers aged 21–40 years.

Evidence suggests that legalization of recreational cannabis will likely increase the number of THC-positive drivers on the road, although cannabis-impaired driving is already an issue on our roads. Public education about the dangers of driving under the influence of cannabis is crucial.

Summary

Driving after cannabis use is a common practice in Canada. The psychoactive component of cannabis, delta-9-tetrahydrocannabinol (THC), causes a dose-dependent impairment to driving capabilities. Divided and sustained attention, reaction time, and tracking are especially affected. People who use cannabis may be aware of the degree of their impairment and attempt to compensate by reducing speed and risk-taking behaviour and increasing following distance.

Alcohol significantly increases impairment when combined with THC, even in small doses of each drug that would be insignificant if taken separately. Combined consumption with alcohol reduces a driver’s compensation capabilities.

Driving after cannabis use increases the risk of being involved in a motor vehicle accident, and also culpability. Cannabis is often found in the blood of drivers involved in motor vehicle accidents. Currently there is no approved roadside screening device for THC – police officers must use observational testing methods to detect impairment and confirm with a biological screening test (blood testing is preferable). It should be noted that blood concentrations of THC do not exactly correlate with impairment until 1–4 hours after inhalation.

It is recommended that individuals wait at least 6 hours after inhaling and 8 hours after ingesting cannabis before driving a motor vehicle to ensure that all impairing effects of THC have subsided.⁵⁹

Cannabis at Work

Prevalence of Cannabis Use in the Workplace

Cannabis is the most commonly detected substance in workplace drug testing.¹⁰⁵ Respondents of the 2017 Canadian Cannabis Survey who indicated past-year cannabis use were asked if they had used cannabis to ‘get high’ before or at work in the past year. The majority of survey respondents (79%) had not used cannabis in such a manner, but 8% reported getting high before or at work on a weekly or daily basis.²¹ 10% stated they did this less than monthly.

Canadians in all sectors of the workforce are using cannabis. Interestingly, employees in the trades, transport and equipment operators, and related occupations had the highest rates of past-month cannabis use in 2014, and also consumed it most frequently.³² This data does not indicate whether the drug was consumed during work hours, but this statistic is surprising considering the safety-sensitive nature and substance use policies of these occupations. Employed persons were more likely to use cannabis than students.³²

Impact of Cannabis on Occupational Injury

Members of the Human Resources Professional Association were surveyed about their preparedness for cannabis legalization.¹⁰⁶ Employers reported their top concerns were employees operating motor vehicles and heavy equipment, disciplinary procedures, absenteeism, and decreased work performance.

Absenteeism is a particular concern for workplace safety. Chronic workplace absenteeism can lead to overworked staff and undertrained temps performing tasks due to a coworker’s absence. Overworked staff results in low morale, leading to a decrease in attention to detail and potentially unsafe work practices.

A study found that of 5367 workers surveyed, 1.2% experienced some negative effects on the job due to illicit drug use, while an additional 7.2% observed negative effects among their colleagues.¹⁰⁷ These negative effects included absenteeism, lost productivity, workplace accidents, conflicts with co-workers, and sanctions by employers. Premature mortality, long-term disability, absenteeism, and presenteeism (impaired performance on the job) due to cannabis use resulted in \$400 million of lost productivity costs in Canada in 2014.¹⁰⁸

The National Academies of Sciences, Engineering, and Medicine completed a systematic review to determine the health effects of cannabis and cannabinoids.¹⁰ Included in this review is a chapter discussing current evidence on the association between cannabis use and occupational injury. The review identified six primary research articles covering the topic but noted that because of various limitations and extreme diversity in study characteristics that there is insufficient evidence to support or refute a statistical association between cannabis use and occupational injury, and indicates that further research is necessary.

The association between cannabis use and occupational injury needs to be explored across a broad range of regions, populations, workplace settings, workplace practices (e.g., drug use

prevention programs, safety standards), worker characteristics (e.g., medical history, history of drug and alcohol use), work patterns, and occupations.¹⁰

Cognitive requirements for safe driving overlap with those required for tasks in safety-sensitive occupations. A safety-sensitive position is one in which incapacity due to drug or alcohol impairment could result in direct and significant risk of injury to the employee, others or the environment.¹⁰⁹ Examples of safety-sensitive industries include health care, law enforcement, transportation, and resource extraction (for example, the oil and gas sector). In a joint guidance statement from the American Association of Occupational Health Nurses and the American College of Occupational and Environmental Medicine, it's stated that "because much of the knowledge regarding impairment and accident risk in the workplace due to alcohol intoxication has been gleaned from studies of driving impairment and crash risk, these same types of studies can be used to assess impairment in the workplace from cannabis."¹¹⁰ Please see the **Effects on Driving** section of this document for more information on cannabis and its effects on various cognitive functions.

Although cannabis impairment may or may not potentiate the risk of occupational injury, new legislation is not likely to change the prevalence of cannabis consumption by a great amount. The National Cannabis Survey (2018) found that only 6% of Canadians who had not used cannabis in the past three months would likely try cannabis or increase their consumption.³¹ However, according to a Deloitte study, 17% of Canadians surveyed indicated they may try cannabis when it is legalized.¹¹¹ Cannabis use is already an issue in the workplace and will continue to be after its legalization in October 2018. What legalization will do is normalize the use of cannabis and encourage people to be more open about their use.

Legislative Requirements

As per the *Occupational Health and Safety Act* of Newfoundland and Labrador, employers have a duty to provide a safe work environment and take all reasonable precautions to ensure the health, safety, and welfare of their workers.¹¹²

Employers also have the duty to accommodate an individual with a diagnosed medical condition or disability, as per the Newfoundland and Labrador *Human Rights Act*.¹¹³ Substance dependence is defined as a disability in the *Canada Human Rights Act*.¹¹⁴ This means that an employer must enable an individual to continue to do their job (or other assigned work, as appropriate) while they are seeking treatment for substance dependence. Those with an authorization to use cannabis for medical purposes have a right to be accommodated as well. Employers are not required to accommodate an employee's use of recreational cannabis or self-medication (using cannabis for medical purposes without proper authorization from a health care professional).

Employers have a duty to accommodate to the point of undue hardship, which is the point beyond which employers are not expected to accommodate.¹⁰⁹ This will look different for every organization, but an employer must demonstrate that they have taken all reasonable measures to accommodate the employee. Undue hardship may be declared if

accommodation would result in substantial costs to the employer or present significant health and safety risks.¹¹⁵

Employers can demonstrate that sobriety or mental acuity is a *bona fide* occupational requirement (BFOR) in order to establish a near zero tolerance policy for cannabis in the workplace. A BFOR is “a work-related requirement that is integral to carrying out the duties of a specific position.”¹¹⁶ When an employer can establish that a standard or requirement is a BFOR, the employer will not be expected to change it to accommodate an employee. Employers should still explore all accommodation options (for example, placing an employee in a different position where absence of impairment is not a BFOR) and seek legal advice if necessary.

According to the Supreme Court of Canada, a standard must meet three criteria in order to be considered a BFOR¹¹⁷:

1. Achieve a purpose that is rationally connected to the work (e.g. safety);
2. Be imposed in good faith;
3. Be reasonably necessary to achieve this purpose.
 - ‘Reasonably necessary’ means that the standard cannot be arbitrary, too broad or stricter than necessary, unnecessary, or so rigid that it cannot accommodate individual circumstances

Employers should conduct job task assessments to determine if sobriety/mental acuity is a BFOR for a certain position. For more information on *bona fide* occupational requirements, please see the Newfoundland and Labrador Human Rights Commission’s *Guidelines for Workplace Alcohol and Drug Testing Policies* (included in the **Additional Resources** section of this document).

Mitigating Workplace Cannabis Use

Cannabis legalization does not give an employee the right to be impaired at work. Employers can implement substance use policies to mitigate cannabis use in the workplace. The policy should include general terms like “impairment” or “under the influence” as this will cover all forms of impairment, not just impairment due to cannabis use. Policies should be developed in collaboration between labour and management.

The Canadian Centre for Occupational Health and Safety suggests that a substance use policy include the following elements¹¹⁵:

- statement of the purpose of the policy
- definition of substance use
- clear definition of impairment, as defined by the employer
- employees/positions to which the substance use policy applies
- statement on an employee’s right to confidentiality
- a mechanism for employees to confidentially report that they have been prescribed an impairing medication
- statement on the allowance or prohibition of the presence of substances in the workplace (medical or non-medical, circumstances in which they are permitted)

- employee education around substance use and dependence
- outline of the process for assisting those with a disability due to substance dependence
- outline of the accommodation process and return to work/remain at work planning
- if applicable, procedures for substance testing (circumstances for testing, how the test will be conducted, how the results will be interpreted)
- progressive discipline procedures

Sample substance use and accommodation policies can be found in Appendix A and B of this document, respectively, which were taken from the Canadian Centre for Occupation Health and Safety's document on workplace strategies for cannabis impairment¹¹⁵ (found in the **Additional Resources** section of this document).

Substance Use Prevention

A workplace environment can contribute to an employee's substance use. Low job satisfaction, monotonous and repetitive jobs, and working in remote or isolated areas may contribute to an employee using substances at work.¹¹⁵ Additionally, workplace factors such as high stress, little job control, long hours, irregular shifts, and fatigue can negatively impact an individual and lead them to substance use.¹¹⁵ Those with a substance dependence may feel stigma or discrimination in disclosing their substance use. Encouragement of disclosure (without penalty) and offers of supports for persons with dependences (such as treatment or counselling)¹¹⁷ will encourage employees to receive the help that they need, when they need it. Workplace Employee Assistance Programs (EAP) can help to support employees with dependences.

The World Health Organization proposes a framework for healthy workplaces and suggests that workplace health promotion programs focus on four key areas: occupational health and safety, psychosocial/organizational culture, personal health resources, and enterprise involvement in the community.¹¹⁸ A great example of a program with this framework is the Hibernia Workforce Mental Health Awareness Program, which has won numerous awards including [recognition from the Canadian Mental Health Association](#).¹¹⁹ Implementation of this framework is recommended to curb substance use in the workplace and foster supportive and healthy workplaces.

Detecting and Responding to Impairment

An employer can determine impairment through observations or drug testing. It is strongly advised to seek legal advice before implementing a substance testing program, as this policy can be seen as discriminatory on the basis of disability or perceived disability (substance use disorder).¹¹⁵ Phillips recommends an overall evaluation of impairment,¹¹⁰ as THC levels in the blood do not necessarily translate to impairment due to various factors (see **Detecting Cannabis-Related Impairment** section of this document for more information).

There are various types of drug testing, including pre-employment testing, random testing, and post-incident testing. Pre-employment testing should only be conducted as part of an overall medical assessment to assess the ability to perform essential duties of the job and should only occur after a conditional offer of employment is made.¹¹⁷ Random testing

should be limited to positions where it is integral for safety and related job duties, however the Ontario Court of Appeal indicated that random drug testing is not justifiable because it is not a reliable measure of impairment, only past use.¹¹⁷ Post-incident testing, which would occur following an accident or a report of dangerous workplace behaviour, should be indicated in an organization's substance use policy and employers should consider if the incident or behaviour may be related to impairment before testing.¹¹⁷ Alternatives to drug testing include on the job performance tests or supervisory reviews.¹¹⁷

However an employer chooses to test for impairment, it is recommended that progressive discipline be practiced including documentation of each suspected failure to comply with the substance policy (incident report). It is also recommended that employers train all personnel on the physical and behavioural signs of cannabis use, ensure consistent policy enforcement in all cases, and that the policy is communicated with all employees. The substance use policy should also be reviewed regularly (once a year is recommended).

The Canada Human Rights Commission identifies the following changes in an employee's attendance, performance, or behaviour that could signify impairment or problematic substance use¹²⁰:

- changes in personality or erratic behaviour
- appearance of impairment at work (e.g. odour of cannabis, reddened conjunctiva, unsteady gait, poor coordination, changes in speech)
- involvement in an accident or working in an unsafe manner
- failing a drug test
- consistent lateness, absenteeism, or reduced productivity or quality of work

The Canada Human Rights Commission advises not to assume and that these changes could be due to a variety of different factors besides substance use.¹²⁰ An employer has the duty to inquire when they observe changes in an employee's performance that could indicate substance dependence. This is a legal obligation under human rights legislation.¹²⁰ Normally the responsibility to disclose accommodation needs would be the employee's, but individuals with a substance dependence may not recognize or admit that they have a disability.¹²⁰ The employer should initiate a discussion with the employee about the possible need for accommodation of a disability. More than one conversation may need to be conducted with the employee.

If an employer suspects impairment, a conversation should take place with the employee in a private area to discuss their behaviour. The employer should explain their safety concerns and ask for an explanation as to what is going on, but never assume that substance use is the cause. It may be necessary to immediately remove the employee from the workplace if they are involved in an accident or near accident and impairment is suspected, their behaviour or performance is having a serious impact on the workplace owing to suspected impairment, or their behaviour puts their safety or that of others at risk.¹²⁰

Medical Cannabis in the Workplace

As mentioned above, employers have a duty to accommodate under provincial and federal human rights legislation. In order to properly accommodate an employee using cannabis for medical purposes, an employer should have sufficient information from a physician or medical professional.

An employee is not required to disclose their medical condition or treatment plan, but the employer should be provided with enough information to show that the employee has a condition that is being treated with cannabis. The employer must ensure that this information and any documentation provided is kept confidential to protect the employee's privacy.

The employer and employee should provide the physician with job details, including hours of work, whether the position is safety-sensitive, specific job tasks and duties, and any other information as deemed necessary.¹¹⁵ The physician should provide details on specific accommodation needs, any limitations or restrictions, sensory acuity, if the employee can safely perform the job, and return to work plans.¹¹⁵ This can be completed through a "fit for work" assessment, where a physician will report one of three conclusions: fit for work, unfit for work, or fit subject to work modifications.¹²¹ If this assessment presents any concerns or limitations, a return to work/remain at work plan can be created and any accommodations can be implemented.

11% of employers surveyed by the Human Resources Professionals Association indicated that they have a policy in place to address medical cannabis.¹⁰⁶ Employers are encouraged to review substance use and prescription medication policies and ensure that there is an emphasis on "impairment," "under the influence," or the ability to work safely, as opposed to mere presence of a substance. Sample substance use and accommodation policies can be found in Appendix A and B, respectively, of this document.

Summary

Cannabis use is prevalent in Canadian workplaces and may increase once the *Cannabis Act* comes into effect. Currently, there is insufficient evidence to conclude if cannabis has an impact on occupational injury, and more research needs to be done to investigate this relationship. Cognitive functions necessary for safe driving overlap with those required in safety-sensitive positions, and it has been established through driving studies that cannabis affects some of these cognitive functions.

Employers have a duty to ensure a safe workplace for all employees, but also accommodate employees who disclose cannabis use for medical purposes or having a substance dependence. Employers may be able to establish a near zero tolerance policy for cannabis in the workplace if they can prove that absence of impairment is a *bona fide* occupational requirement.

In the days leading to cannabis legalization, employers should review substance policies to ensure a focus on impairment and the ability to perform work safely. Because impairment is not always related to THC levels in the body, employers should consider alternatives to drug

testing like on the job performance tests and supervisory reviews to be included in an overall assessment of impairment.

If impairment is suspected, employers should have a conversation with the employee and should never assume that substance use is the cause for a change in behaviour. Document using incident reports and practice progressive discipline. An employer has a duty to inquire if they observe changes in an employee that could signify substance dependence.

Employers can prevent substance use in the workplace by fostering healthy and supportive workplace environments. Implementation of the World Health Organization's framework for healthy workplaces is recommended.

Cannabis at Home

Unintentional Exposures

Canadian adults can choose to possess and use cannabis while still employing appropriate measures to ensure the safety of children who reside in the home. The presence of cannabis at home places children at risk of unintentional exposures and could result in serious health concerns.

A 2016 study found that unintentional pediatric exposures to cannabis in Colorado increased significantly following legalization in 2014 (regional poison control center calls for cannabis exposures increased by 34%).¹²² Cannabis was not stored in child-resistant packaging in 9% of exposures. In 34% of cases, cannabis was not stored properly or the child was inadequately supervised.

A systematic review of pediatric cannabis exposures found that hashish (cannabis resin) was the most commonly documented oral exposure.¹²³ Hashish could be mistaken as a chocolate bar by a child as it is solid and brown in colour. Edibles and ingestion of unfinished joints were the next most common sources of exposure.

Edible products will not be regulated in Canada until approximately a year after the *Cannabis Act* comes into force, but adults will be permitted to make their own cannabis-infused foods and beverages until they become available under the legal regime. Proper storage of these products at home is crucial in preventing accidental cannabis exposures, as edibles are attractive and palatable to children and nearly impossible to distinguish from non-infused products. Furthermore, edible products can contain very high THC concentrations (one cookie could have up to 1000mg THC meant to be consumed in multiple doses over time¹²³), leading to symptom development from as little as one serving.¹²⁴

The severity of symptoms and need for medical evaluation from an unintentional cannabis exposure appear to result from a combination of age, dose of THC, and administration form.¹²² The most common physical symptoms encountered are ataxia^{iv}, hypotonia^v, lethargy, tachycardia, and hypoventilation.¹²³ Younger children are more likely to present with central nervous system effects like lethargy, which can further lead to complications like respiratory insufficiency, airway compromise, and aspiration risk.¹²⁴ If you observe these symptoms or otherwise suspect a child has consumed a cannabis product, call the Newfoundland and Labrador Poison Control Centre toll-free at 1-866-722-1126.

Pets are also vulnerable to cannabis exposures, especially dogs. A study of two veterinary hospitals in Colorado found that increasing issuances of medical cannabis licenses resulted in increased incidence of cannabis toxicosis in dogs.¹²⁵ The most common clinical signs observed were ataxia, disorientation, dilated pupils, urinary incontinence, hyperesthesia^{vi},

^{iv} Lack of muscle coordination, unsteady gait

^v Muscle weakness

^{vi} Excessive physical sensitivity, especially of the skin

tremors, and vomiting.¹²⁵ Dogs also have the added concern of combined toxicity with chocolate, an ingredient often used in edible products.

Children’s Hospital Colorado has compiled a list of safety precautions that individuals can take should they wish to store cannabis in their homes.¹²⁶

- When storing cannabis, remember ‘up and away.’
 - **Up:** Keep cannabis products in a place that is hard to reach for children. Choose a location that is high off the ground so that children cannot reach or see it.
 - **Away:** Put cannabis products away every time after use, even if you plan on using again later. Always dispose of waste products like ashes and unfinished joints.
- Store cannabis products in their original packaging. The *Cannabis Regulations* require cannabis to be sold in child-resistant packaging, which is already in use in the medical cannabis market.¹²⁷ It is recommended to continue storing cannabis in this packaging upon purchase.
- Consider storing cannabis in a lock box. Storing cannabis out of reach and sight and in child-resistant packaging still may not be enough to keep children from accessing it. Storing in a lock box is a safe and convenient way to ensure children are protected from cannabis exposure. In fact, New Brunswick’s cannabis legislation requires cannabis to be stored in a locked container or room to ensure it is away from minors.¹²⁸
- Request that your guests store any purses, coats, or bags containing cannabis products in a secure place while they are in your home.
- If you use a babysitter, ensure that they are mature, responsible, and recommended by someone you trust. Ask them to keep any cannabis products ‘up and away’ while caring for your child, whether that be at your home or theirs.
- Talk about cannabis safety with adults whose homes your child may visit. This could include relatives, neighbours, or the parents of a classmate.

Cannabis Use

Parents can choose to use cannabis, but must ensure reasonable measures are in place to protect the safety of themselves and their families. Here are some tips on how to use cannabis responsibly:

- Make sure there is one sober parent at all times. Please practice responsible parenting and do not use cannabis in situations where you are the sole caregiver of

your child.

- Avoid using cannabis around children and youth. Cannabis smoke contains similar toxins to tobacco smoke, including several carcinogens, which could be harmful to one's health if inhaled through passive exposure (second-hand smoke).¹²⁹ Not to mention, adolescents from families where one or both parents ever used cannabis have a significantly higher prevalence of cannabis use when compared to those whose parents have no history of using cannabis.¹³⁰ This could be for a number of reasons, but role modeling and access to drug use have been cited as possibilities.¹³⁰
- Never drive high. For more information on cannabis and its effect on driving, please refer to the **Cannabis on the Road** chapter of this document.

Home Cultivation

In addition to possessing and using cannabis, Canadian adults will be permitted to grow up to four (4) cannabis plants in their homes. Individuals authorized to use cannabis under the *Access to Cannabis for Medical Purposes Regulations* are already permitted to grow cannabis at home or designate someone to do it for them.³³ The National Collaborating Centre on Environmental Health conducted a literature review on this matter and concluded that home cultivation presents health and safety concerns in five key areas: access and accidental poisoning, indoor air quality, use of pesticides, electrical and fire hazards, and radiation hazards.¹³¹

Increased Access

Home cultivation gives children and pets increased access to cannabis if appropriate safety measures and precautions are not in place. It is recommended to have a dedicated grow space with controlled access, which can be achieved by using strong locks and installing a home monitoring or alarm system.¹³² Ensure that all excess cannabis plant preparations are disposed of properly and rendered unfit for use or consumption to protect children and pets. This can be done by blending the cannabis with water and mixing it with cat litter before disposing of it.¹³²

Home cultivation will not only present exposure to cannabis plants, but will likely lead to increased amounts of cannabis being stored in the home. Personal cultivation could lead to an accumulation of cannabis product as there is no in-home possession limit.¹³¹ Practice the aforementioned safety precautions for cannabis use and possession.

Indoor Air Quality

Excess moisture is a key determinant of indoor mould growth, and mould is associated with effects on human health.¹³³ Health Canada recommends that indoor relative humidity levels be kept at around 50% in the summer and 30% in the winter to prevent mould growth.¹³⁴ Mould is associated with respiratory conditions like asthma, upper respiratory tract symptoms, coughing, wheezing, and respiratory infections.¹³⁵

Indoor grow operations can elevate relative humidity levels. Cannabis plants require varying levels of humidity depending on stages of the growth cycle. For example, seedlings require high levels of relative humidity – around 65-70%.¹³⁶ As cannabis plants mature, the humidity levels necessary for healthy growth decrease.¹³⁶ However, mature plants still contribute to indoor humidity as they transpire irrigation water as vapour.¹³¹

Homes already have a number of sources of moisture from cooking, bathing, dishwashing, and occupants' respiration, for example.¹³¹ The moisture contribution of home cultivation combined with other household sources could exceed the home's capacity to properly ventilate. Most climate-controlled, energy efficient homes in Canada have low ventilation rates, and a modelling exercise found that as few as 4–10 mature cannabis plants could create a moisture issue.¹³¹ Adhere to federal laws and limit home cultivation to a maximum of four plants.

Cannabis plants can contribute to indoor mould growth even if relative humidity levels are low. Powdery mildew and other mould and mildew species commonly infest cannabis crops. While this is not a human pathogen, it may contribute to indoor mould growth and particulate matter, exacerbating allergic sensitivity or irritation.¹³¹ Mouldy plants should be rendered unfit for use and disposed of immediately.

Home cultivation can also affect the carbon monoxide (CO) levels in a home. CO is a by-product of propane or gas-powered carbon dioxide (CO₂) generators ("burners") which are sometimes used to enhance plant growth and increase yield.¹³⁷ CO levels can also be affected by alteration to a home's ventilation capacity, or by using methods to increase CO₂ levels like venting furnaces or water heaters directly into the grow room.¹³¹ Carbon monoxide poisoning can lead to health problems and, at high levels of exposure, even death.¹³⁸

Pesticides

Cannabis crops are susceptible to pests such as moulds, blights, and insects, and also fungi when the plants are being dried and cured.¹³¹ Growers may opt to use pesticides to prevent loss of crops. The Pest Management Regulatory Agency (PMRA) has approved 21 pesticides for use on cannabis that is produced commercially indoors.¹³⁹ However, not all of these pesticides are suitable for home cultivation. Cannabis cultivation forums suggest that inappropriate pesticides are being used by home growers that could be hazardous to health.¹³¹ It is recommended to grow cannabis organically (without pesticides) or outside until there is further guidance provided by PMRA about which pesticides are suitable for home use.

Electrical and Fire Hazards

Cannabis grow equipment has been identified as an electrical and fire risk.¹⁴⁰ One study reported that, over a five year period, 6.8% of founded indoor grow operations in the Cariboo region of British Columbia caught fire.¹⁴¹ Another study reported that homes with indoor grow operations are 24 times more likely to catch fire than homes without.¹⁴²

High wattage lamps (500–1000W) are often used in indoor grow-ops which produce enough heat to cause serious burns.¹³¹ Additionally, grow equipment can draw large amounts of power, increasing the risk of shocks and electrical overloads, which could lead to a fire. To accommodate the increased power demand, growers may make electrical circuit alterations which are unsafe and unapproved and pose significant electrocution and fire risk.¹⁴³ Grow rooms can contain flammable materials, like fertilizers, compressed gas (CO₂), and dried plant material, further increasing the risk of an explosion and decreasing time to escape should a fire occur.¹³¹

The National Collaborating Centre on Environmental Health recommends using LED lighting systems as they reduce energy usage and heat emission.¹³¹

Radiation Hazards

Grow operations may use ultraviolet (UV) light to increase THC content in the resin of the cannabis plants (UV-A/B) or to control fungal spores (UV-C).¹³¹ Bulbs may be tampered with to increase UV output. Exposure to UV light can lead to skin and eye damage,¹⁴⁴ so it is recommended to wear personal protective equipment (sunglasses and clothing that covers skin) if using UV light to grow cannabis.

Solvent Extraction

Chemically concentrated cannabis extracts use solvents to extract cannabinoids (like THC) from cannabis. One concentrate in particular, butane hash oil (BHO), also known as shatter, honey oil, or wax, uses butane as a solvent which is an extremely volatile substance. Butane hash oil is attractive to consumers for two reasons: it has a high THC content (up to 90%)¹⁴⁵, and it can be made using waste material from home cultivation.

Production of BHO involves “blasting” a pressurized organic solvent (such as compressed butane) through an open-ended column or tube filled with cannabis. The liquid that flows from the bottom of the tube is collected and is then purged using a heat source until thick, golden-coloured BHO remains.¹³¹ Purging or evaporating flammable solvents creates a fire hazard, and a flame could easily ignite should an ignition source be present.¹³¹

Amateur extraction labs have been the cause of many explosions in states like Colorado¹⁴⁵ and California¹⁴⁶ where recreational cannabis is legal. They are becoming a growing concern in Canada as well.¹⁴⁷ Serious burns from these explosions have become a growing public health problem, and will certainly persist once the *Cannabis Act* comes into effect.

A study examined burn cases resulting from BHO explosions in Colorado from 2008 to 2014 (medical liberalization of cannabis occurred in 2009 and recreational cannabis was legalized in 2014).¹⁴⁵ The study found 0 BHO-related burn cases pre-liberalization, 19 cases during medical liberalization, and 12 cases after legalization (the study only accounted for 8 months of legalization). Notably, 93% of cases were flash burns resulting from explosions in an enclosed space, and the average hospital stay required was 10 days.

BHO operations and explosions became such a large problem in the county of San Bernardino, California, that regulations were implemented regarding the commercial sale of butane. Individuals buying three or more 300mL cylinders of butane are required to confirm

their age and provide their contact information, and the purchase of more than four cylinders is prohibited from a single commercial establishment.¹⁴⁸ Canada has not announced any limitations on the purchase of butane post-legalization.

It is worth noting that, like edibles, cannabis concentrates will not be regulated in Canada until a year after the *Cannabis Act* comes into effect. However, unlike edibles, producing concentrates using organic solvents (such as butane) will be illegal.³⁴ Considering the increase in BHO operations and explosions post-legalization in Colorado and California, the increasing consumer demand for BHO, and there being no reasonable access to the product through the legal market until 2019, an increase in BHO explosions in Canada post-legalization will not be surprising.

Harm Reduction

There are certain cannabis consumption practices that can be used in order to minimize the adverse health effects of cannabis use. Table 2 is a summary of the Lower-Risk Cannabis Use Guidelines (LRCUG) which were developed through findings of a systematic review of modifiable risk factors for cannabis-use related health harms compiled by Fischer et al.⁷⁹

Table 2: Summary of Low-Risk Cannabis Use Guidelines

Risk Factor	Recommendation	Rationale
Age of Initiation	Avoid early age initiation of cannabis use (definitely before the age of 16 years)	Early onset cannabis use is associated with mental health problems and cannabis dependence later in life, perhaps because of its effect on the developing brain.
Choice of Cannabis Products	Opt for products with low THC concentrations, or high CBD:THC ratios. Avoid use of synthetic cannabinoids (i.e. Spice, K2)	High THC content is a risk factor for acute and chronic health outcomes, including mental health and substance dependence. CBD has been shown to attenuate the intoxicating, sedating, and cardiovascular effects of THC. However, CBD must be present in high doses to achieve this. Synthetic cannabinoids have been associated with an array of severe adverse side effects that are more severe than organic cannabis use.
Cannabis Use Practices	Non-smoking administration methods, such as edibles, oils,	Regular cannabis smoking is associated with various

	<p>or tinctures, are preferred over smoking cannabis. Vaporizers are preferred over smoking combusted cannabis material.</p> <p>Avoid breath-holding or deep inhalation practices meant to increase the absorption of THC.</p>	<p>pulmonary and bronchial problems (coughing, wheezing, shortness of breath, etc.), as well as acute bronchitis and impaired respiratory health.</p> <p>Bongs or water pipes reduce burnt particle inhalation but increase intake of tar and particulate matter. Transmission of infectious disease (e.g. tuberculosis) has also been reported.</p> <p>Vaporizers do not combust cannabis which reduces the risk of respiratory problems associated with inhalation of combustion byproducts.</p> <p>“Dabbing” (see Methods of Consumption) increases the risk of hydrocarbon burns and inhalation of solder, rust, and benzene.</p> <p>Edibles have a delayed onset of psychoactive effects resulting in a potentially larger-than-intended dose. However, edibles do eliminate the risk of respiratory problems associated with smoking.</p> <p>Practices such as breath-holding or deep inhalation increase the intake of hazardous byproducts, like tar, carbon monoxide, and carcinogens.</p>
Frequency and Intensity of Use	Users should limit cannabis use to occasional at most (e.g. once a week, weekends only, etc.)	<p>Frequent cannabis use (daily or near-daily) is a predictor of various acute and chronic cannabis-related problems:</p> <ul style="list-style-type: none"> ▪ mental health problems ▪ cardiovascular problems

		<ul style="list-style-type: none"> ▪ motor vehicle accidents ▪ suicidality ▪ changes in brain structure ▪ neurocognitive effects ▪ cannabis dependence
Special Risk Populations	<p>People with a predisposition for, or first-degree family history of, psychosis and substance use disorders should refrain from using cannabis.</p> <p>Pregnant women should not use cannabis.</p>	<p>Individuals with a personal or family history of psychosis make up a substantial proportion of cannabis-attributed psychosis cases.</p> <p>Using cannabis during pregnancy is associated with low birth weight, higher odds of placement in neonatal intensive care units, fetal growth reduction, and increased risk of maternal anaemia.</p>

It is also suggested by the authors that combining several risk behaviours will magnify the risk of adverse health outcomes related to cannabis (for example, early age of initiation combined with frequent use will likely disproportionately increase the risk of acute and chronic problems). Please refer to the Lower-Risk Cannabis Use Guidelines for detailed explanations of the evidence which supports these recommendations (found in the **Additional Resources** section of this document).

Summary

Legalization in other jurisdictions resulted in increased cases of pediatric cannabis exposures, pet cannabis exposures, and explosions and serious burns related to butane hash oil production.

Proper storage of cannabis is crucial to protecting children from accessing the substance. Store ‘up and away’ and keep products in their original, child-resistant packaging.

There are a number of concerns associated with home cultivation of cannabis, including increased access for children and pets, indoor air quality, pesticides, electrical and fire hazards, and radiation hazards.

Certain risk factors dispose consumers to greater health risks associated with cannabis. Consumption of products with high THC content and synthetic cannabinoids should be avoided. Starting to use cannabis at an early age, using it daily or near-daily, and regularly using inhalation methods to consume is not advisable.

Conclusion

Cannabis legalization will likely have at least some effect on safety at home, at work, and on the road. As more Canadians have expressed a willingness to try cannabis once it is legalized or increase their consumption, we may see more cannabis-impaired drivers on our roads, increased prevalence of cannabis use in the workplace, and increased incidents relating to community safety.

Current evidence on cannabis and its impact on various areas of safety is certainly lacking and some areas need to be explored further. Legalization will make it easier for this important research to take place. In particular, cannabis and its impact on workplace safety must be investigated as high quality studies are limited.

The recommendations provided in this document can be used to effectively mitigate safety risks associated with cannabis. A summary of recommendations can be found on the following page.

Summary of Recommendations

Safety on the Road

- Wait at least 6 hours after inhaling cannabis and 8 hours after ingesting it before driving. Wait even longer if euphoric effects are still felt.
- Never drive under the influence of cannabis in combination with alcohol.

Safety at Work

- Review substance use policies to ensure a focus on impairment or the ability to work safely as opposed to the mere presence of a substance.
- Seek legal advice before implementing a substance testing program.
- Include an overall evaluation of impairment in policies (observations and, if applicable, biological testing). Consider alternatives to substance testing like on the job performance testing and supervisory reviews.
- Progressive discipline should be practiced in cases of suspected impairment.
- Document instances of suspected impairment using incident reports.
- Train all employees about the physical and behavioural signs of cannabis use.
- Enforce policies consistently.
- Ensure all employees are aware of the policy.
- Regularly review policies (at least annually).
- Use fit for work assessments to aid in accommodation of employees who use cannabis for medical purposes or those with substance dependences.
- Never assume that substance use is the cause of a change in an employee's behaviour or performance.
- Ensure all employee information is kept confidential.
- Implement the WHO framework for healthy workplaces.

Safety at Home

- Store cannabis 'up and away' and in its original packaging.
- Discuss cannabis safety with any visitors (guests, babysitters) in your home, and with any adults whose homes your child may visit.
- Consider storing cannabis in a locked box.
- Ensure one sober parent at all times.
- Avoid using cannabis around children or youth.
- Secure grow rooms with strong locks and a home monitoring or alarm system.
- Render any cannabis waste material unfit for use before disposing of it by mixing it with water and cat litter.
- Adhere to the legal limit for home cultivation (four plants) to prevent moisture problems.
- Dispose of mouldy plants immediately.
- Grow cannabis organically or outside until guidance is provided on pesticides suitable for home cultivation.
- Use LED lighting systems for growing to reduce energy usage and heat emission.

- Wear personal protective equipment if you choose to use UV lighting in the grow room.
- **POLICY RECOMMENDATION:** Regulate the purchase of butane to curb amateur solvent extraction labs.
- Using cannabis at an early age should be avoided.
- Avoid using synthetic cannabinoids and products with high THC concentrations.
- Non-smoking administration methods should be used, like vapourization, edibles, and oils.
- Avoid breath-holding and deep inhalation practices.
- Limit use to occasional at the most (once a week, weekend only, etc).
- People with a personal or family history of psychosis and substance disorders and pregnant women should avoid using cannabis.

Additional Resources

Cannabis and Driving: Evidence Review
Canadian Drug Policy Coalition

https://drugpolicy.ca/wp-content/uploads/2017/02/CDPC_Cannabis-and-Driving_Evidence-Review_FINALV2_March27-2017.pdf

Workplace Strategies: Risk of Impairment from Cannabis
Canadian Centre on Occupational Health and Safety

https://www.ccohs.ca/products/publications/cannabis_whitepaper.pdf

Guidelines for Workplace Alcohol and Drug Testing Policies
Newfoundland and Labrador Human Rights Commission

<https://thinkhumanrights.ca/education-and-resources/guidelines/guidelines-for-workplace-alcohol-and-drug-testing-policies/#footnote-19>

Growing at Home: Health and Safety Concerns for Personal Cannabis Cultivation
National Collaborating Centre on Environmental Health

http://www.ncceh.ca/sites/default/files/Growing_At_Home_Health_Safety_Personal_Cannabis_Cultivation_Mar_2018.pdf

Lower-Risk Cannabis Use Guidelines
Benedikt Fischer et al

<https://ajph.aphapublications.org/doi/10.2105/AJPH.2017.303818>

Lower-Risk Cannabis Use Guidelines for public use
Benedikt Fischer et al

https://www.cma.ca/Assets/assets-library/document/en/advocacy/cma_policy_canadas_lower_risk_cannabis_use_pd16-06-e.pdf

Sensible Cannabis Education: A Toolkit for Educating Youth
Canadian Students for Sensible Drug Policy

<https://www.cpha.ca/sites/default/files/uploads/conferences/2018/Sensible-Cannabis-Education-A-Toolkit-for-Educating-Youth.pdf>

Appendix A: Sample Workplace Substance Use Policy

The following was taken from Appendix A of *Workplace Strategies: Risk of Impairment from Cannabis* by the Canadian Centre on Occupational Health and Safety, which was adapted from the Atlantic Canada Council on Addiction's toolkit to address problematic substance use that impacts the workplace.¹¹⁵

Title: Substance Dependence/Impairment

Relevant Legislation: Occupational Health and Safety Act; Human Rights Act

Purpose:

ABC Organization is accountable to create a safe environment for patients, families, staff, volunteers and members of the public. This duty includes addressing any issue that may impair an employee's ability to perform their work functions responsibly.

Policy:

All individuals working at ABC Organization (including volunteers and contractors) are expected to report fit for duty for scheduled work and be able to perform assigned duties safely and acceptably without any limitations due to use or after effects of alcohol, illicit drugs, non-prescription drugs, prescribed medications, or any other substance that may impair judgment or performance.

ABC Organization has taken the position that the presence of illicit drugs, recreational drugs and alcohol on the worksite is not permitted.

Any individual failing to adhere to this policy will be subject to discipline up to and including dismissal.

Procedures:

Managers and supervisors are to identify and handle all situations promptly where there are concerns about an individual's ability to perform his or her job safely.

Employees who are assessed and suspected to be impaired while at work will be sent home immediately. Transportation will be arranged. The supervisor is responsible for documenting any incidence of suspected impairment.

Employees are encouraged to inform their supervisor or another named person(s) about any situation that may compromise their safety or the safety of others, or impair their performance.

ABC Organization will use “fit to work” procedures, and provide accommodations (where appropriate). ABC Organization honours that disabilities are protected through human rights legislation. ABC Organization will provide support for employees by providing access to confidential assessment, counselling, treatment, and after-care services. Employees who have substance dependence are strongly encouraged to seek assistance through the Employee Assistance Program. All voluntary referrals to the Employee Assistance Program are kept confidential.

Employees shall advise their supervisor whenever they have any concerns about their colleagues’ fitness or duties.

The Human Resource contact will work with the immediate supervisor to determine appropriate disciplinary action if necessary.

The Manager will ensure adherence to reporting requirements with the appropriate licensing bodies.

Signed: _____

Effective Date: _____

Appendix B: Sample Workplace Accommodation Policy

The following was taken from Appendix C of *Workplace Strategies: Risk of Impairment from Cannabis* by the Canadian Centre on Occupational Health and Safety, which was in turn provided by the Canadian Human Rights Commission.¹¹⁵

[Name of Organization] Accommodation Policy and Procedures

Policy Statement

[Name of Organization] is committed to fostering an inclusive workplace where all employees are treated with respect and dignity.

[Name of Organization] will act in a manner consistent with its obligations under the Canadian Human Rights Act [insert; “and the Employment Equity Act, and (title of provincial or territorial human rights legislation)” if applicable].

[Name of Organization] will provide a workplace that ensures equal opportunity free from discrimination based on race, colour, national or ethnic origin, religion, age, sex (includes pregnancy or child-birth), sexual orientation, gender identity or expression, marital status, family status, genetic characteristics, disability (includes mental or physical disability, disfigurement and dependence on alcohol or a drug) or conviction for an offence for which a pardon has been granted or a record suspended.

[Name of Organization] will provide workplace accommodation, to the point of undue hardship. The purpose of accommodation is to ensure that individuals who are otherwise able to work are not discriminated against by being excluded from doing so when working conditions can be adjusted without causing undue hardship to the employer.

Application

This policy applies to all current employees and applicants for employment of [Name of Organization], including full and part-time, casual, contract, permanent, and temporary employees. This policy also applies to employees on approved leave including short and long-term disability leave.

This policy applies to all aspects of employment including, but not limited to recruitment, selection, training, promotion, transfers, work arrangements, compensation and benefits, and termination of employment.

Definitions

An **Inclusive Workplace** means that all employees have the opportunity to contribute and participate in the workplace in a barrier free environment. Critical to the notion of an inclusive workplace is a robust accommodation policy.

Accommodation means taking steps to adjust rules, policies, practices or situations that have a negative impact on an individual or groups, protected under the Canadian Human Rights Act.

Undue Hardship occurs when accommodation adjustments to the workplace would be prohibitively expensive, or create undue risks to health or safety. Each situation will be viewed as unique and assessed individually. A claim of undue hardship must be supported with facts and a detailed analysis of options, impressionistic or speculative reasons will not suffice.

The following are examples where accommodation could cause undue hardship:

- an employer cannot accommodate without seriously impacting business operations;
- an employee will not be able to return to work in the foreseeable future or is absent so often that it is no longer possible to accommodate them without causing the employer serious financial hardship;
- the employee's position is safety sensitive and, as a result, accommodation may pose a safety risk to the employee, his or her colleagues, clients and/or the public.

Responsibilities and Expectations

Accommodation is a shared responsibility between employees, supervisors and **[Name of Organization]**, as the employer.

[Name of Organization] is responsible for:

- eliminating barriers that prevent people from accessing, or being included in, the workplace;
- minimizing the need for individual accommodation by regularly reviewing rules, policies, by-laws and practices to ensure that they are not discriminatory;
- ensuring that all employees and job applicants are advised of their right to be accommodated;
- dealing with requests for accommodation in a timely, confidential and sensitive manner;
- providing individual accommodation to the point of undue hardship; and
- ensuring that this policy is effectively implemented.

Supervisors are responsible for:

- fostering an inclusive work environment by treating all employees and job applicants with respect and dignity;
- identifying and eliminating barriers that prevent people from accessing, or being included in, the workplace;
- dealing with requests for accommodation in a timely, confidential and sensitive manner;
- informing individuals requiring accommodation what information they need to provide to be accommodated;
- generating accommodation options based on the information provided about the individual's accommodation need(s)
- involving individuals requiring accommodation in the search for accommodation;

- initiating a discussion about accommodation when they are aware that an employee or job applicant may have a need for accommodation, but is unable, for any reason, to articulate that need.

Employees and job applicants are responsible for:

- making their accommodation needs known. This does not require the disclosure of the specific cause of their needs but only the effects which create the need for accommodation.
- helping to identify potential accommodation options;
- providing documentation in support of their request for accommodation, including information about any restrictions or limitations; and
- accepting an offer of accommodation that meets their needs, even if it is not their preferred accommodation option.

Employees and job applicants can expect:

- to be treated with respect and dignity;
- to have their needs accommodated up to the point of undue hardship; and
- to be informed of the reasons, if their accommodation request is denied.

Procedures for Accommodation

Job Applicants

When contacted for an interview, job applicants will be advised that **[Name of Organization]** has an accommodation policy and asked whether he or she requires accommodation to participate in the hiring process.

[Name and/or Position A] will evaluate the job applicant's request for accommodation and may request more information from the applicant to facilitate the accommodation.

If a request for accommodation is denied, the reasons why will be clearly communicated to the job applicant.

Employees

An employee may request accommodation by notifying his or her supervisor. Alternatively, accommodation needs may be identified through supervisor and employee collaboration in response to concerns raised by the supervisor.

The supervisor will document the request, including the employee's name, position and date of the request, any details provided by the employee and any accommodation options suggested by the employer or employee.

The supervisor may request supporting documentation from the employee in order to identify accommodation needs and options (e.g. details of restrictions or limitations).

When dealing with an accommodation request based on disability, the supervisor should refer to Annex A which provides guidance on asking for medical information to support the accommodation request.

The supervisor will consider accommodation options including, but not limited to: workstation adjustments; reassignment of job tasks; changes to scheduling or hours of work; leaves of absence; and temporary or permanent reassignment.

The supervisor will discuss available accommodation options with the employee. The accommodation preferences of the employee will be taken into account. However, the supervisor may proceed with an option that is less costly or easier to provide, when it meets the employee's accommodation needs. The supervisor will clearly communicate the reasons for his or her decision to the employee.

The supervisor will review the accommodation measures with the employee on a regular basis to confirm they continue to be necessary and effective.

If the available accommodation options raise the likelihood of causing undue hardship, the supervisor will refer the matter to **[Name and/or Position B]** for decision.

[Name and/or Position B] will ensure that all accommodation options short of undue hardship have been considered prior to refusing accommodation. If a request for accommodation is denied, **[Name and/or Position B]** will clearly communicate the reasons why to the employee.

Appeals

If an employee or applicant has been denied accommodation, is not satisfied with the accommodation offered, or believes that his or her request has not been handled in accordance with this policy, he or she may request a second opinion from **[Name and/or Position C]**.

An employee or applicant may also file a discrimination complaint with the Canadian Human Rights Commission **[insert "and (title of other grievance mechanism)" if applicable]**.

Privacy and Confidentiality

All records associated with accommodation requests will be maintained in a secure location, separate from employees' personnel files and will only be shared with persons who need the information.

[Name of Organization] and all individuals involved in the accommodation process will comply with the requirements of the **[insert "(title of applicable privacy legislation)"]** to protect personal information.

Review

[Name and/or Position A] will review this policy and related procedures on an annual basis, or as required, and will make adjustments as necessary to ensure that it continues to meet the needs of all employees.

Enquiries

Enquiries about this policy and related procedures can be made to [Name and/or Position B].

Date: [Month, day, year]

References

1. ElSohly MA, ed. *Marijuana and the Cannabinoids*. Totowa, NJ: Humana Press; 2007. doi:10.1007/978-1-59259-947-9.
2. Aizpurua-Olaizola O, Soydaner U, Öztürk E, et al. Evolution of the Cannabinoid and Terpene Content during the Growth of *Cannabis sativa* Plants from Different Chemotypes. *J Nat Prod*. 2016;79(2):324-331. doi:10.1021/acs.jnatprod.5b00949.
3. Mackie K. Cannabinoid Receptors as Therapeutic Targets. *Annu Rev Pharmacol Toxicol*. 2006;46(1):101-122. doi:10.1146/annurev.pharmtox.46.120604.141254.
4. Di Marzo V, Melck D, Bisogno T, De Petrocellis L. Endocannabinoids: endogenous cannabinoid receptor ligands with neuromodulatory action. *Trends Neurosci*. 1998;21(12):521-528. doi:10.1016/S0166-2236(98)01283-1.
5. Bisogno T, Hanuš L, De Petrocellis L, et al. Molecular targets for cannabidiol and its synthetic analogues: effect on vanilloid VR1 receptors and on the cellular uptake and enzymatic hydrolysis of anandamide. *Br J Pharmacol*. 2001;134(4):845-852. doi:10.1038/sj.bjp.0704327.
6. Mechoulam R, Shani A, Edery H, Grunfeld Y. Chemical basis of hashish activity. *Science*. 1970;169(3945):611-612. <http://www.jstor.org/stable/1730378>. Accessed May 8, 2018.
7. Ashton CH. Adverse effects of cannabis and cannabinoids. *Br J Anaesth*. 1999;83(4):637-649. doi:10.1093/bja/83.4.637.
8. Beirness DJ, Porath A. Clearing the Smoke on Cannabis: Cannabis Use and Driving. 2016. [http://www.ccdus.ca/Resource Library/CCSA-Cannabis-Use-Driving-Report-2017-en.pdf](http://www.ccdus.ca/Resource%20Library/CCSA-Cannabis-Use-Driving-Report-2017-en.pdf). Accessed May 14, 2018.
9. Canadian Centre on Substance Abuse. Canadian Drug Summary: Cannabis. 2015.
10. National Academies of Sciences Engineering and Medicine. *The Health Effects of Cannabis and Cannabinoids*. Washington, D.C.: National Academies Press; 2017. doi:10.17226/24625.
11. Brady KT, Balster RL. The effects of delta-9-tetrahydrocannabinol alone and in combination with cannabidiol on fixed-interval performance in rhesus monkeys. *Psychopharmacology (Berl)*. 1980;72(1):21-26. doi:10.1007/BF00433803.
12. Wright MJ, Vandewater SA, Taffe MA. Cannabidiol attenuates deficits of visuospatial associative memory induced by Δ^9 tetrahydrocannabinol. *Br J Pharmacol*. 2013;170(7):1365-1373. doi:10.1111/bph.12199.
13. Fasinu PS, Phillips S, ElSohly MA, Walker LA. Current Status and Prospects for Cannabidiol Preparations as New Therapeutic Agents. *Pharmacother J Hum Pharmacol Drug Ther*. 2016;36(7):781-796. doi:10.1002/phar.1780.
14. Iffland K, Grotenhermen F. An update on safety and side effects of cannabidiol: A

- review of clinical data and relevant animal studies. *Cannabis Cannabinoid Res.* 2017;2(1):139-154. doi:10.1089/can.2016.0034.
15. Pertwee RG. Targeting the endocannabinoid system with cannabinoid receptor agonists: pharmacological strategies and therapeutic possibilities. *Philos Trans R Soc B Biol Sci.* 2012;367(1607):3353-3363. doi:10.1098/rstb.2011.0381.
 16. Russo EB. History of Cannabis and Its Preparations in Saga, Science, and Sobriquet. *Chem Biodivers.* 2007;4(8):1614-1648. doi:10.1002/cbdv.200790144.
 17. Niesink RJM, Rigtter S, Koeter MW, Brunt TM. Potency trends of Δ^9 -tetrahydrocannabinol, cannabidiol and cannabinol in cannabis in the Netherlands: 2005-15. *Addiction.* 2015;110(12):1941-1950. doi:10.1111/add.13082.
 18. Steep Hill Labs. Cannabinol (CBN): A Sleeping Synergy. [https://www.steepphill.com/blogs/34/Cannabinol-\(CBD\):-A-Sleeping-Synergy](https://www.steepphill.com/blogs/34/Cannabinol-(CBD):-A-Sleeping-Synergy). Published 2017. Accessed May 14, 2018.
 19. Karniol IG, Shirakawa I, Takahashi RN, Knobel E, Musty RE. Effects of Δ^9 -Tetrahydrocannabinol and Cannabinol in Man. *Pharmacology.* 1975;13(6):502-512. doi:10.1159/000136944.
 20. Grotenhermen F. Pharmacokinetics and Pharmacodynamics of Cannabinoids. *Clin Pharmacokinet.* 2003;42(4):327-360. doi:10.2165/00003088-200342040-00003.
 21. Statistics Canada. Canadian cannabis survey 2017 - Summary. <https://www.canada.ca/en/health-canada/services/publications/drugs-health-products/canadian-cannabis-survey-2017-summary.html>. Published 2017. Accessed May 15, 2018.
 22. Ashton CH. Pharmacology and effects of cannabis: A brief review. *Br J Psychiatry.* 2001;178(02):101-106. doi:10.1192/bjp.178.2.101.
 23. Ridgeway G, Kilmer B. Bayesian inference for the distribution of grams of marijuana in a joint. *Drug Alcohol Depend.* 2016;165:175-180. doi:10.1016/j.drugalcdep.2016.06.004.
 24. Gieringer D, St. Laurent J, Goodrich S. Cannabis Vaporizer Combines Efficient Delivery of THC with Effective Suppression of Pyrolytic Compounds. *J Cannabis Ther.* 2004;4(1):7-27. doi:10.1300/J175v04n01_02.
 25. Hollister LE, Gillespie HK, Ohlsson A, Lindgren JE, Wahlen A, Agurell S. Do plasma concentrations of delta 9-tetrahydrocannabinol reflect the degree of intoxication? *J Clin Pharmacol.* 1981;21(8-9 Suppl):171S-177S. <http://www.ncbi.nlm.nih.gov/pubmed/6271822>.
 26. Grotenhermen F. Harm Reduction Associated with Inhalation and Oral Administration of Cannabis and THC. *J Cannabis Ther.* 2001;1(3-4):133-152. doi:10.1300/J175v01n03_09.
 27. Health Canada. About cannabis. <https://www.canada.ca/en/health-canada/services/drugs-medication/cannabis/about.html>. Published 2018. Accessed

- May 15, 2018.
28. Francis M. The Different Methods Of Cannabis Ingestion. Cresco Labs. <https://www.crescolabs.com/cannabis-ingestion-methods/>. Published 2016. Accessed May 17, 2018.
 29. United Nations Office on Drugs and Crime. *World Drug Report 2016*. New York; 2016. www.unodc.org/wdr2016/.
 30. Statistics Canada. Canadian Tobacco Alcohol and Drugs (CTADS): 2015 summary. <https://www.canada.ca/en/health-canada/services/canadian-tobacco-alcohol-drugs-survey/2015-summary.html>. Published 2017. Accessed May 18, 2018.
 31. Statistics Canada. *National Cannabis Survey, First Quarter 2018*.; 2018. <https://www.statcan.gc.ca/daily-quotidien/180418/dq180418b-eng.pdf>. Accessed May 17, 2018.
 32. Hango D, LaRoche-Côté S. Association between the frequency of cannabis use and selected social indicators. *Insights on Canadian Society*. <http://www.statcan.gc.ca/pub/75-006-x/2018001/article/54968-eng.htm>. Published 2018. Accessed May 18, 2018.
 33. Health Canada. Information on the new Access to Cannabis for Medical Purpose Regulations. <https://www.canada.ca/en/health-canada/services/drugs-health-products/medical-use-marijuana/medical-use-marijuana.html>. Published 2016. Accessed May 18, 2018.
 34. Government of Canada. Legislative Background: An Act respecting cannabis and to amend the Controlled Drugs and Substances Act, the Criminal Code and other Acts (Bill C-45). 2017. https://lop.parl.ca/About/Parliament/LegislativeSummaries/bills_ls.asp?ls=c45&Parl=42&Ses=1&source=library_prb&Language=E. Accessed May 18, 2018.
 35. Government of Canada. Legislative Background: reforms to the Transportation Provisions of the Criminal Code (Bill C-46). <http://www.justice.gc.ca/eng/csjsjc/pl/sidl-rlcfa/c46/p3.html>. Published 2017. Accessed May 18, 2018.
 36. Government of Newfoundland and Labrador. Provincial Government Releases First Details on Cannabis Legalization in Newfoundland and Labrador. 2017. <http://www.releases.gov.nl.ca/releases/2017/exec/1123n01.aspx>. Accessed July 31, 2018.
 37. *Cannabis Control Act*. Government of Newfoundland and Labrador; 2018. <https://www.assembly.nl.ca/Legislation/sr/statutes/c04-1.htm>. Accessed August 7, 2018.
 38. Government of Newfoundland and Labrador. New Drug Impaired Driving Laws Further Strengthen Legislation. <http://www.releases.gov.nl.ca/releases/2018/servicenl/0528n04.aspx>. Published 2018. Accessed July 31, 2018.
 39. Beirness DJ, Beasley EE. Alcohol and Drug Use Among Drivers: British Columbia

- Roadside Survey 2010. 2010. http://www.ccsa.ca/ResourceLibrary/2011_CCSA_Alcohol_and_Drug_Use_Among_Drivers_en.pdf. Accessed May 29, 2018.
40. Beasley EE, Beirness DJ. Alcohol and Drug Use Among Drivers Following the Introduction of Immediate Roadside Prohibitions in British Columbia: Findings from the 2012 Roadside Survey. 2012. <https://www2.gov.bc.ca/assets/gov/driving-and-transportation/driving/publications/bc-roadside-report2012.pdf>. Accessed May 29, 2018.
 41. Minaker L, Bonham A, Elton-Marshall T, Leos-Toro C, Wild TC, Hammond D. Under the influence: examination of prevalence and correlates of alcohol and marijuana consumption in relation to youth driving and passenger behaviours in Canada. A cross-sectional study. *C Open*. 2017;5(2):E386-E394. doi:10.9778/cmajo.20160168.
 42. Stoduto G, Vingilis E, Kapur BM, Sheu W-J, McLellan BA, Liban CB. Alcohol and drug use among motor vehicle collision victims admitted to a regional trauma unit: demographic, injury, and crash characteristics. *Accid Anal Prev*. 1993;25(4):411-420. doi:10.1016/0001-4575(93)90070-D.
 43. Beirness DJ, Beasley EE, Boase P. Drug Use Among Fatally Injured Drivers in Canada. In: Watson B, Sheehan M, eds. *Proceedings of the International Conference on Alcohol, Drugs and Traffic Safety*. Brisbane: ICADTS; 2013. http://www.icadtsinternational.com/files/documents/2013_015.pdf. Accessed May 29, 2018.
 44. Crean RD, Crane NA, Mason BJ. An Evidence-Based Review of Acute and Long-Term Effects of Cannabis Use on Executive Cognitive Functions. *J Addict Med*. 2011;5(1):1-8. doi:10.1097/ADM.0b013e31820c23fa.
 45. Curran V, Brignell C, Fletcher S, Middleton P, Henry J. Cognitive and subjective dose-response effects of acute oral Δ^9 -tetrahydrocannabinol (THC) in infrequent cannabis users. *Psychopharmacology (Berl)*. 2002;164(1):61-70. doi:10.1007/s00213-002-1169-0.
 46. Ameri A. The effects of cannabinoids on the brain. *Prog Neurobiol*. 1999;58(4):315-348. doi:10.1016/S0301-0082(98)00087-2.
 47. D'Souza DC, Perry E, MacDougall L, et al. The Psychotomimetic Effects of Intravenous Delta-9-Tetrahydrocannabinol in Healthy Individuals: Implications for Psychosis. *Neuropsychopharmacology*. 2004;29(8):1558-1572. doi:10.1038/sj.npp.1300496.
 48. Ramaekers JG, Moeller MR, van Ruitenbeek P, Theunissen EL, Schneider E, Kauert G. Cognition and motor control as a function of Δ^9 -THC concentration in serum and oral fluid: Limits of impairment. *Drug Alcohol Depend*. 2006;85(2):114-122. doi:10.1016/j.drugalcdep.2006.03.015.
 49. Hartman RL, Huestis MA. Cannabis Effects on Driving Skills. *Clin Chem*. 2013;59(3):478-492. doi:10.1373/clinchem.2012.194381.
 50. Sexton B, Tunbridge R, Brook-Carter N, et al. *The Influence of Cannabis on Driving*;

2000. <https://trl.co.uk/sites/default/files/TRL477.pdf>. Accessed June 7, 2018.
51. Sewell RA, Poling J, Sofuoglu M. The Effect of Cannabis Compared with Alcohol on Driving. *Am J Addict*. 2009;18(3):185-193. doi:10.1080/10550490902786934.
 52. Robbe H. Marijuana's impairing effects on driving are moderate when taken alone but severe when combined with alcohol. *Hum Psychopharmacol Clin Exp*. 1998;13:S70-S78.
 53. Ramaekers JG, Robbe HWJ, O'Hanlon JF. Marijuana, alcohol and actual driving performance. *Hum Psychopharmacol Clin Exp*. 2000;15(7):551-558. doi:10.1002/1099-1077(200010)15:7<551::AID-HUP236>3.0.CO;2-P.
 54. Lenné MG, Dietze PM, Triggs TJ, Walmsley S, Murphy B, Redman JR. The effects of cannabis and alcohol on simulated arterial driving: Influences of driving experience and task demand. *Accid Anal Prev*. 2010;42(3):859-866. doi:10.1016/j.aap.2009.04.021.
 55. Ménétrey A, Augsburger M, Favrat B, et al. Assessment of Driving Capability Through the Use of Clinical and Psychomotor Tests in Relation to Blood Cannabinoids Levels Following Oral Administration of 20 mg Dronabinol or of a Cannabis Decoction Made with 20 or 60 mg Δ^9 -THC*. *J Anal Toxicol*. 2005;29(5):327-338. doi:10.1093/jat/29.5.327.
 56. Ronen A, Gershon P, Drobiner H, et al. Effects of THC on driving performance, physiological state and subjective feelings relative to alcohol. *Accid Anal Prev*. 2008;40(3):926-934. doi:10.1016/j.aap.2007.10.011.
 57. Ronen A, Chassidim HS, Gershon P, et al. The effect of alcohol, THC and their combination on perceived effects, willingness to drive and performance of driving and non-driving tasks. *Accid Anal Prev*. 2010;42(6):1855-1865. doi:10.1016/j.aap.2010.05.006.
 58. Anderson BM, Rizzo M, Block RI, Pearlson GD, O'Leary DS. Sex differences in the effects of marijuana on simulated driving performance. *J Psychoactive Drugs*. 2010;42(1):19-30.
 59. Canadian Public Health Association. Frequently asked questions about pot and driving. 2018. https://www.cpha.ca/sites/default/files/uploads/resources/cannabis/Pot + Driving 2018/pot+driving_faq_e.pdf. Accessed June 18, 2018.
 60. Chait LD, Fischman MW, Schuster CR. 'Hangover' effects the morning after marijuana smoking. *Drug Alcohol Depend*. 1985;15(3):229-238. doi:10.1016/0376-8716(85)90002-X.
 61. Fant R V, Heshman SJ, Bunker EB, Pickworth WB. Acute and Residual Effects of Marijuana in Humans. *Pharmacol Biochem Behav*. 1998;60(4):777-784.
 62. Hall W, Solowij N. Adverse effects of cannabis. *Lancet*. 1998;352(9140):1611-1616. doi:10.1016/S0140-6736(98)05021-1.

63. Pope HG, Gruber AJ, Hudson JI, Huestis MA, Yurgelun-Todd D. Cognitive measures in long-term cannabis users. *J Clin Pharmacol*. 2002;42(11 Suppl):41s-47s.
64. Bolla KI, Eldreth D, Matochik J, Cadet J. Neural substrates of faulty decision-making in abstinent marijuana users. *Neuroimage*. 2005;26(2):480-492. doi:10.1016/j.neuroimage.2005.02.012.
65. Bolla KI, Brown K, Eldreth D, Tate K, Cadet JL. Dose-related neurocognitive effects of marijuana use. *Neurology*. 2002;59(9):1337-1343. doi:10.1212/01.WNL.0000031422.66442.49.
66. Solowij N. Do cognitive impairments recover following cessation of cannabis use? *Life Sci*. 1995;56(23-24):2119-2126. doi:10.1016/0024-3205(95)00197-E.
67. Battistella G, Fornari E, Annoni J-M, et al. Long-Term Effects of Cannabis on Brain Structure. *Neuropsychopharmacology*. 2014;39(9):2041-2048. doi:10.1038/npp.2014.67.
68. Bondallaz P, Favrat B, Chtioui H, Fornari E, Maeder P, Giroud C. Cannabis and its effects on driving skills. *Forensic Sci Int*. 2016;268:92-102. doi:10.1016/J.FORSCIINT.2016.09.007.
69. MacDonald S, Mann R, Chipman M, et al. Driving Behavior Under the Influence of Cannabis or Cocaine. *Traffic Inj Prev*. 2008;9(3):190-194. doi:10.1080/15389580802040295.
70. Smiley AM. Marijuana: On Road and Driving Simulator Studies. *Alcohol, Drugs Driv*. 1986;2:121-134.
71. Ramaekers JG, Berghaus G, van Laar M, Drummer O. Dose related risk of motor vehicle crashes after cannabis use. *Drug Alcohol Depend*. 2004;73(2):109-119. doi:10.1016/j.drugalcdep.2003.10.008.
72. Desrosiers NA, Ramaekers JG, Chauchard E, Gorelick DA, Huestis MA. Smoked Cannabis' Psychomotor and Neurocognitive Effects in Occasional and Frequent Smokers. *J Anal Toxicol*. 2015;39(4):251-261. doi:10.1093/jat/bkv012.
73. Bosker WM, Kuypers KPC, Theunissen EL, et al. Medicinal Δ^9 -tetrahydrocannabinol (dronabinol) impairs on-the-road driving performance of occasional and heavy cannabis users but is not detected in Standard Field Sobriety Tests. *Addiction*. 2012;107(10):1837-1844. doi:10.1111/j.1360-0443.2012.03928.x.
74. Grotenhermen F, Leson G, Berghaus G, et al. *Developing Science-Based Per Se Limits for Driving under the Influence of Cannabis (DUI): Findings and Recommendations by an Expert Panel.*; 2005. <http://www.canorml.org/healthfacts/DUIcreport.2005.pdf>. Accessed June 12, 2018.
75. Ramaekers JG, Kauert G, Theunissen E, Toennes S, Moeller M. Neurocognitive performance during acute THC intoxication in heavy and occasional cannabis users. *J Psychopharmacol*. 2009;23(3):266-277. doi:10.1177/0269881108092393.
76. Karler R, Turkanis SA. *Different Cannabinoids Exhibit Different Pharmacological and*

- Toxicological Properties.*; 1987.
<https://archives.drugabuse.gov/sites/default/files/monograph79.pdf#page=105>.
77. Wall ME, Perez-Reyes M. The metabolism of delta 9-tetrahydrocannabinol and related cannabinoids in man. *J Clin Pharmacol.* 1981;21(S1):178S-189S.
<http://www.ncbi.nlm.nih.gov/pubmed/6271823>.
 78. Gjerde H, Strand MC, Mørland J. Driving Under the Influence of Non-Alcohol Drugs—An Update Part I: Epidemiological Studies. *Forensic Sci Rev.* 2015;27(2):89-113.
<http://www.ncbi.nlm.nih.gov/pubmed/26227253>. Accessed June 14, 2018.
 79. Fischer B, Russell C, Sabioni P, et al. Lower-Risk Cannabis Use Guidelines: A comprehensive update of evidence and recommendations. *Am J Public Health.* 2017;107(8):e1-e12. doi:10.2105/ AJP.2017.303818.
 80. Downey LA, King R, Papafotiou K, et al. The effects of cannabis and alcohol on simulated driving: Influences of dose and experience. *Accid Anal Prev.* 2013;50(2013):879-886. doi:10.1016/j.aap.2012.07.016.
 81. Walsh JM, Flegel R, Cangianelli LA, Atkins R, Soderstrom CA, Kerns TJ. Epidemiology of Alcohol and Other Drug Use Among Motor Vehicle Crash Victims Admitted to a Trauma Center. *Traffic Inj Prev.* 2004;5(3):254-260. doi:10.1080/15389580490465319.
 82. Verstraete AG, Legrand S, Vandam L, Hughes B, Griffiths P. *Drug Use, Impaired Driving and Traffic Accidents*. Lisbon; 2014. doi:10.2810/26821.
 83. Subbaraman MS, Kerr WC. Simultaneous Versus Concurrent Use of Alcohol and Cannabis in the National Alcohol Survey. *Alcohol Clin Exp Res.* 2015;39(5):872-879. doi:10.1111/acer.12698.
 84. Rogeberg O, Elvik R. The effects of cannabis intoxication on motor vehicle collision revisited and revised. *Addiction.* 2016;111(8):1348-1359. doi:10.1111/add.13347.
 85. Blomberg RD, Peck RC, Moskowitz H, Burns M, Fiorentino D. Crash Risk of Alcohol Involved Driving: A Case-Control Study. 2005.
<http://www.dunlapandassociatesinc.com/crashriskofalcoholinvolveddriving.pdf>. Accessed June 18, 2018.
 86. Mann RE, Stoduto G, Ialomiteanu A, Asbridge M, Smart RG, Wickens CM. Self-Reported Collision Risk Associated With Cannabis Use and Driving After Cannabis Use Among Ontario Adults. *Traffic Inj Prev.* 2010;11(2):115-122.
doi:10.1080/15389580903536704.
 87. Drummer OH, Gerostamoulos J, Batziris H, et al. The involvement of drugs in drivers of motor vehicles killed in Australian road traffic crashes. *Accid Anal Prev.* 2004;36(2):239-248. doi:10.1016/S0001-4575(02)00153-7.
 88. Longo MC, Hunter CE, Lokan RJ, White JM, White MA. The prevalence of alcohol, cannabinoids, benzodiazepines and stimulants amongst injured drivers and their role in driver culpability Part II: The relationship between drug prevalence and drug concentration, and driver culpability. *Accid Anal Prev.* 2000;32:623-632.
www.elsevier.com/locate/aap. Accessed June 18, 2018.

89. Poulsen H, Moar R, Pirie R. The culpability of drivers killed in New Zealand road crashes and their use of alcohol and other drugs. *Accid Anal Prev.* 2014;67:119-128. doi:10.1016/j.aap.2014.02.019.
90. Biecheler M-B, Peytavin J-F, the SAM Group, Facy F, Martineau H. SAM Survey on “Drugs and Fatal Accidents”: Search of Substances Consumed and Comparison between Drivers Involved under the Influence of Alcohol or Cannabis. *Traffic Inj Prev.* 2008;9(1):11-21. doi:10.1080/15389580701737561.
91. Royal Canadian Mounted Police. Drug Recognition Expert Evaluations. <http://www.rcmp-grc.gc.ca/ts-sr/dree-eert-eng.htm>. Published 2014. Accessed June 18, 2018.
92. Capler R, Bilsker D, Van Pelt K, MacPherson D. Cannabis Use and Driving: Evidence Review. 2017. https://drugpolicy.ca/wp-content/uploads/2017/02/CDPC_Cannabis-and-Driving_Evidence-Review_FINALV2_March27-2017.pdf. Accessed June 18, 2018.
93. Grotenhermen F, Leson G, Berghaus G, et al. Developing limits for driving under cannabis. *Addiction.* 2007;102(12):1910-1917. doi:10.1111/j.1360-0443.2007.02009.x.
94. Huestis MA, Cone EJ. Relationship of Delta 9-tetrahydrocannabinol concentrations in oral fluid and plasma after controlled administration of smoked cannabis. *J Anal Toxicol.* 2004;28(6):394-399. <http://www.ncbi.nlm.nih.gov/pubmed/15516285>.
95. Milman G, Schwoppe DM, Schwilke EW, et al. Oral Fluid and Plasma Cannabinoid Ratios after Around-the-Clock Controlled Oral 9-Tetrahydrocannabinol Administration. *Clin Chem.* 2011;57(11):1597-1606. doi:10.1373/clinchem.2011.169490.
96. Canadian Centre on Substance Abuse. *Oral Fluid Drug Screening (Policy Brief).*; 2018. www.ccsa.ca. Accessed June 18, 2018.
97. Maykut MO. Health consequences of acute and chronic marijuana use. *Prog Neuropsychopharmacol Biol Psychiatry.* 1985;9(3):209-238. <http://www.ncbi.nlm.nih.gov/pubmed/3898227>.
98. Musshoff F, Madea B. Review of Biologic Matrices (Urine, Blood, Hair) as Indicators of Recent or Ongoing Cannabis Use. *Ther Drug Monit.* 2006;28(2):155-163. doi:10.1097/01.ftd.0000197091.07807.22.
99. Charlton J, Koppel S, Odell M, et al. *Influence of Chronic Illness on Crash Involvement of Motor Vehicle Drivers.* Clayton, AU; 2010. https://www.monash.edu/__data/assets/pdf_file/0008/216386/muarc300.pdf. Accessed August 6, 2018.
100. Health Canada. Access to Cannabis for Medical Purposes Regulations - Daily Amount Fact Sheet (Dosage). <https://www.canada.ca/en/health-canada/services/drugs-medication/cannabis/information-medical-practitioners/cannabis-medical-purposes-regulations-daily-amount-fact-sheet-dosage.html>. Published 2016. Accessed August 6, 2018.
101. Tefft BC, Arnold LS, Grabowski JG. *Prevalence of Marijuana Involvement in Fatal*

- Crashes: Washington, 2010-2014*. Washington, D.C.; 2016.
<https://aaaafoundation.org/wp-content/uploads/2017/12/PrevalenceOfMarijuanaInvolvement.pdf>. Accessed June 18, 2018.
102. Santaella-Tenorio J, Mauro CM, Wall MM, et al. US Traffic Fatalities, 1985–2014, and Their Relationship to Medical Marijuana Laws. *Am J Public Health*. 2017;107(2):336-342. doi:10.2105/AJPH.2016.303577.
 103. Reiman A. Cannabis as a substitute for alcohol and other drugs. *Harm Reduct J*. 2009;6(1):35. doi:10.1186/1477-7517-6-35.
 104. Kim JH, Santaella-Tenorio J, Mauro C, et al. State Medical Marijuana Laws and the Prevalence of Opioids Detected Among Fatally Injured Drivers. *Am J Public Health*. 2016;106(11):2032-2037. doi:10.2105/AJPH.2016.303426.
 105. Els C, Admin A, Straube S. Marijuana and the Workplace. *Can J Addict*. 2016;7(4):5-7. http://www.csam-smca.org/wp-content/uploads/2014/07/CJAM-Vol5No2_June-Final.pdf.
 106. Human Resources Professionals Association. Clearing the haze: The impacts of marijuana in the workplace. 2017. <https://www.hrpa.ca/Documents/Public/HRPA-Clearing-The-Haze.pdf>.
 107. Lambrechts M-C, Vandersmissen L, Godderis L. Alcohol and other drugs among workers: prevalence and job related consequences. In: *Poster Presentation*. BMJ Publishing Group Ltd; 2017:A58-A59. doi:10.1136/oemed-2017-104636.155.
 108. Canadian Substance Use Costs and Harms Scientific Working Group. *Canadian Substance Use Costs and Harms (2007-2014)*. Ottawa, ON; 2018. <http://www.ccsa.ca/ResourceLibrary/CSUCH-Canadian-Substance-Use-Costs-Harms-Report-2018-en.pdf>. Accessed August 9, 2018.
 109. Canadian Human Rights Commission. Canadian Human Rights Commission's Policy on Alcohol and Drug Testing. 2009. http://publications.gc.ca/collections/collection_2009/ccdp-chrc/HR4-6-2009E.pdf. Accessed August 2, 2018.
 110. Phillips JA, Holland MG, Baldwin DD, et al. Marijuana in the Workplace. *J Occup Environ Med*. 2015;57(4):459-475. doi:10.1097/JOM.0000000000000441.
 111. Deloitte. Recreational Marijuana Insights and Opportunities. 2017. https://www2.deloitte.com/content/dam/Deloitte/ca/Documents/Analytics/ca-en-analytics-DELOITTE-Recreational-Marijuana-POV-ENGLISH-FINAL_AODA.pdf. Accessed July 3, 2018.
 112. Government of Newfoundland and Labrador. *Occupational Health and Safety Act*; 2014. https://www.assembly.nl.ca/Legislation/sr/statutes/o03.htm#4_. Accessed August 2, 2018.
 113. Government of Newfoundland and Labrador. *Human Rights Act*; 2010. https://www.assembly.nl.ca/Legislation/sr/statutes/h13-1.htm#14_. Accessed

- August 2, 2018.
114. Government of Canada. *Canadian Human Rights Act.*; 1985. <http://laws-lois.justice.gc.ca/eng/acts/h-6/FullText.html>. Accessed August 2, 2018.
 115. Canadian Centre for Occupational Health and Safety. *Workplace Strategies: Risk of Impairment from Cannabis 2nd Edition*. 2nd ed. Canadian Centre for Occupational Health and Safety; 2018. https://www.ccohs.ca/products/publications/cannabis_whitepaper.pdf. Accessed August 2, 2018.
 116. Human Rights Commission. Employer's Guide to the Human Rights Act. 2012. http://communitysector.nl.ca/sites/default/files/practical_resources/2012/handout__1_human_rigths_commission_employer_guide.pdf. Accessed August 2, 2018.
 117. Human Rights Commission Newfoundland and Labrador. Guidelines For Workplace Alcohol And Drug Testing Policies. <https://thinkhumanrights.ca/education-and-resources/guidelines/guidelines-for-workplace-alcohol-and-drug-testing-policies/#footnote-19>. Accessed August 2, 2018.
 118. Burton J. *WHO Healthy Workplace Framework and Model*. Geneva; 2010. http://www.who.int/occupational_health/healthy_workplace_framework.pdf. Accessed August 6, 2018.
 119. CMHA British Columbia. CMHA presents the 2017 CM Hincks Workplace Award to Hibernia. <https://cmha.bc.ca/news/cmha-presents-the-2017-cm-hincks-workplace-award-to-hibernia/>. Published 2017. Accessed August 6, 2018.
 120. Canada Human Rights Commission. Impaired at work: A guide to accommodating substance dependence. 2017. http://www.chrc-ccdpc.ca/sites/default/files/impaired_at_work.pdf. Accessed August 9, 2018.
 121. Canadian Centre for Occupational Health and Safety. Fit to Work Fact Sheet. https://www.ccohs.ca/oshanswers/psychosocial/fit_to_work.html. Published 2016. Accessed August 6, 2018.
 122. Wang GS, Le Lait M-C, Deakyne SJ, Bronstein AC, Bajaj L, Roosevelt G. Unintentional Pediatric Exposures to Marijuana in Colorado, 2009-2015. *JAMA Pediatr*. 2016;170(9):e160971. doi:10.1001/jamapediatrics.2016.0971.
 123. Richards JR, Smith NE, Moulin AK. Unintentional Cannabis Ingestion in Children: A Systematic Review. *J Pediatr*. 2017;190:142-152. doi:10.1016/j.jpeds.2017.07.005.
 124. Thomas AA, Moser E, Dickerson-Young T, Mazor S. A Review of Pediatric Marijuana Exposure in the Setting of Increasing Legalization. *Clin Pediatr Emerg Med*. 2017;18(3):159-162. doi:10.1016/j.cpem.2017.07.003.
 125. Meola SD, Tearney CC, Haas SA, Hackett TB, Mazzaferro EM. Evaluation of trends in marijuana toxicosis in dogs living in a state with legalized medical marijuana: 125 dogs (2005-2010). *J Vet Emerg Crit Care*. 2012;22(6):690-696. doi:10.1111/j.1476-4431.2012.00818.x.

126. Children's Hospital Colorado. Marijuana Safety in the Home. <https://www.childrenscolorado.org/conditions-and-advice/marijuana-what-parents-need-to-know/safety/>. Accessed July 18, 2018.
127. Government of Canada. Cannabis Regulations: SOR/2018-144. Canada Gazette. <http://www.gazette.gc.ca/rp-pr/p2/2018/2018-07-11/html/sor-dors144-eng.html>. Published 2018.
128. Government of New Brunswick. Legislation concerning cannabis control and drug-impaired driving. http://www2.gnb.ca/content/gnb/en/news/news_release.2017.11.1433.html. Published 2017. Accessed July 18, 2018.
129. Wang GS. Pediatric Concerns Due to Expanded Cannabis Use: Unintended Consequences of Legalization. *J Med Toxicol*. 2017;13(1):99-105. doi:10.1007/s13181-016-0552-x.
130. Vermeulen-Smit E, Verdurmen JEE, Engels RCME, Vollebergh WAM. The role of general parenting and cannabis-specific parenting practices in adolescent cannabis and other illicit drug use. *Drug Alcohol Depend*. 2015;147:222-228. doi:10.1016/j.drugalcdep.2014.11.014.
131. Eykelbosh A, Steiner L. Growing at home: Health and safety concerns for personal cannabis cultivation. 2018. http://www.nceeh.ca/sites/default/files/Growing_At_Home_Health_Safety_Personal_Cannabis_Cultivation_Mar_2018.pdf.
132. Health Canada. Information bulletin: safety and security considerations when producing cannabis for your own medical purposes. <https://www.canada.ca/en/health-canada/services/information-bulletin-safety-security-considerations-producing-cannabis-for-own-medical-purposes.html>. Published 2016. Accessed July 23, 2018.
133. Palaty C, Shum M. *Mould Assessment Recommendations*. Vancouver, BC; 2014. http://www.nceeh.ca/sites/default/files/Mould_Assessment_Evidence_Review_March_2014.pdf. Accessed July 27, 2018.
134. Health Canada. Reduce humidity, moisture and mould. <https://www.canada.ca/en/health-canada/services/air-quality/indoor-air-contaminants/reduce-humidity-moisture-mould.html>. Published 2015. Accessed July 27, 2018.
135. Palaty C, Shum M. *Health Effects from Mould Exposure or Dampness in Indoor Environments*. Vancouver, BC; 2012. http://www.nceeh.ca/sites/default/files/Mould_and_Health_Effects_Jul_2012.pdf. Accessed July 27, 2018.
136. Royal Queen Seeds. Indoor Cannabis Growing: Relative Humidity and Temperatures. <https://www.royalqueenseeds.com/blog-indoor-cannabis-growing-relative-humidity-and-temperatures-n243>. Published 2016. Accessed July 27, 2018.
137. Hennings T. How to Use CO2 to Increase Cannabis Yields. Leafly.

- <https://www.leafly.com/news/growing/co2-for-growing-marijuana-plants>. Published 2017. Accessed July 27, 2018.
138. Health Canada. Prevent carbon monoxide poisoning. <https://www.canada.ca/en/health-canada/services/air-quality/indoor-air-contaminants/keep-carbon-monoxide-out-your-home.html>. Published 2017. Accessed July 30, 2018.
 139. Health Canada. Health Canada Testing of Cannabis for Medical Purposes for Unauthorized Pest Control Products. <https://www.canada.ca/en/health-canada/services/drugs-medication/cannabis/licensed-producers/policies-directives-guidance-information-bulletins/testing-cannabis-medical-purposes-unauthorized-pest-control-products.html>. Published 2018. Accessed July 31, 2018.
 140. Garis L, Clare J. *Regulatory Options to Prevent the Unsafe Use of High-Powered Hydroponic Equipment*. Abbotsford, BC; 2013. <https://www.ufv.ca/media/assets/criminal-justice-research/UFV-Research-Note-Regulatory-Options-to-Prevent-Unsafe-Use-of-Hydroponics-Equipment--v3.pdf>. Accessed July 30, 2018.
 141. Plecas D, Chaisson K, Garis L. *The Nature and Extent of Marihuana Growing Operations in the Cariboo Region of British Columbia: A 14 Year Review (1997-2010)*. Abbotsford, BC; 2011. <http://www.bcstats.gov.bc.ca/data/pop/pop/BCPop.asp>. Accessed July 30, 2018.
 142. Plecas D, Malm A, Kinney B. *Marihuana Growing Operations in British Columbia Revisited 1997-2003*. Abbotsford, BC; 2005.
 143. Garis L. *Eliminating Residential Marijuana Grow Operations: An Alternate Approach*. Surrey, BC; 2005.
 144. Health Canada. Health effects of ultraviolet radiation. <https://www.canada.ca/en/health-canada/services/sun-safety/health-effects-ultraviolet-radiation.html>. Published 2018. Accessed July 30, 2018.
 145. Bell C, Slim J, Flaten HK, Lindberg G, Arek W, Monte AA. Butane Hash Oil Burns Associated with Marijuana Liberalization in Colorado. *J Med Toxicol*. 2015;11(4):422-425. doi:10.1007/s13181-015-0501-0.
 146. Romanowski KS, Barsun A, Kwan P, et al. Butane Hash Oil Burns: A 7-Year Perspective on a Growing Problem. *J Burn Care Res*. 2017;38(1):e165-e171. doi:10.1097/BCR.0000000000000334.
 147. Williams JM. *Marijuana Butane Honey Oil (BHO) Extraction Fire and Explosion Investigations*. Midhurst; 2017. <https://www.omfpoa.com/wp-content/uploads/2017/06/BHO-Paper-Final-PDF.pdf>. Accessed August 6, 2018.
 148. Marquez L. Ontario passes butane ordinance regulating quantities sold. *The Inland Valley Daily Bulletin*. <https://www.dailybulletin.com/2016/05/21/ontario-passes-butane-ordinance-regulating-quantities-sold/>. Published May 21, 2016.