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Clearing the Smoke on Cannabis

Cannabis Use and Driving

– An Update

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This is the third in a series of reports that reviews the effects of cannabis use on various aspects of human functioning and development. This report on the effects of cannabis use on driving provides an update of a previous report with new research findings that validate and extend our understanding of this issue. Other reports in this series address the effects of regular cannabis use on cognitive functioning and mental health, use during pregnancy and breastfeeding, respiratory and cardiovascular effects of cannabis smoking, medical use of cannabis and cannabinoids, and edible cannabis products, cannabis extracts and cannabis topicals. This series is intended for a broad audience, including health professionals, policy makers and researchers.

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Key Points

- Driving after using cannabis is more prevalent than driving after drinking, particularly among young drivers.
- Cannabis impairs the cognitive and motor abilities necessary to operate a motor vehicle and doubles the risk of crash involvement.
- Cannabis now rivals alcohol as the most commonly detected substance among drivers who die in traffic crashes.
- Police have various tools at their disposal to detect and arrest drivers who are impaired by cannabis.

Background

After alcohol, cannabis is the most widely used psychoactive substance in Canada. According to the National Cannabis Survey in 2020, 20.0% of people aged 15 years and older in Canada (about 6.2 million individuals) reported using cannabis at least once in the past three months (Rotermann, 2021). That was higher than the 17.5% who reported doing so within the first few months following the legalization of nonmedical cannabis use (i.e., the first quarter of 2019). It is also significantly higher than the 14.0% who reported doing so a year previously (first quarter of 2018), before legalization (Rotermann, 2021). The use of cannabis is generally more prevalent among younger people in Canada, with 35.6% of those aged 18 to 24 years reporting use in the three months before the survey. About 40.0% of people in Canada aged 15 years and older who used cannabis in the previous three months reported using cannabis daily or almost daily (Rotermann, 2021).

A growing body of evidence suggests that cannabis use can negatively impact several aspects of people's lives, including mental and physical health, cognitive functioning, ability to drive a motor vehicle, and pre- and postnatal development among children (Volkow et al., 2014). This report provides an update on the topic of cannabis use and driving. It is one in a series reviewing the effects of cannabis use on various aspects of human functioning and development (see Gabrys, 2020; Gabrys & Porath, 2019; Kalant & Porath-Waller, 2016; Konefal et al., 2019; Renard, 2020; Renard & Konefal, 2022).

After more than three decades of successful efforts to change behaviour and increase social intolerance of driving while impaired by alcohol, drug-impaired driving remains an important public health and road safety issue, particularly with the legalization of nonmedical cannabis use in Canada. This report presents the evidence on the prevalence of driving following the use of cannabis, the impact of cannabis on driving performance and collision risk, and the detection of drivers who are impaired by this substance. This report concludes with a discussion of the implications for policy and practice.

Cannabis is a greenish or brownish material consisting of the dried flowering, fruiting tops and leaves of the cannabis plant, Cannabis sativa*. Hashish or cannabis resin is the dried brown or black resinous secretion of the flowering tops of the cannabis plant. Cannabis can be consumed by smoking, vaporization, ingestion (edible cannabis), oral application of tinctures and topical application of creams, oils and lotions. Cannabis consists of more than 100 cannabinoids, but delta-9-tetrahydrocannabinol (THC) is the main psychoactive ingredient responsible for the high feeling. Another cannabinoid, cannabidiol (CBD) does not have psychoactive properties but may interact with THC. The acute effects of cannabis include euphoria and relaxation, changes in perception, time distortion, deficits in attention span and memory, body tremors, increased heart rate and blood pressure, and impaired motor functioning. During the past few decades, there has been an increase in the concentrations of THC (and decrease in CBD levels) in illicit cannabis from 4% in 1995 to 12% in 2014 (ElSohly et al., 2016). Canada legalized the use of cannabis for nonmedical purposes for individuals 18 years of age and older (19 in some provinces) on Oct. 17, 2018. A review of Canadian online cannabis retail outlets revealed that dried cannabis products have up to 30% THC, and products in the 20% to 28% THC range are common. Extracts, including oils, dabs and edible cannabis can contain even higher concentrations of THC.*

What Is Drug-impaired Driving?

Drug-impaired driving refers to the operation of a motor vehicle while one's ability is adversely affected by a drug, including illegal drugs, legal drugs, prescription drugs, over-the-counter medications and volatile inhalants such as toluene or nitrous oxide.

Drug-impaired driving is a criminal offence in Canada. According to the *Criminal Code of Canada* (Government of Canada, 2022), it is an offence to operate or have care and control of a motor vehicle while the person's ability to operate the vehicle is impaired to *any degree* by alcohol, a drug or both. The law applies to the operation of a "conveyance," which includes any type of motor vehicle (including snowmobiles, all-terrain vehicles, vessels, aircraft and railway equipment). It also does not matter whether the vehicle is being operated on a public roadway or on private property. It is an equivalent offence to fail or refuse to comply with an officer's demand for a sample of breath, blood or oral fluid or to perform tests of impairment.

Amendments to the *Criminal Code* (Government of Canada, 2018) made it an offence to operate a conveyance with a blood drug concentration that is equal to or exceeds the concentration prescribed by regulation.[1] For cannabis, there are three limits for tetrahydrocannabinol (THC), the chemical primarily responsible for the psychoactive effects of cannabis:

- a low blood drug concentration of 2 nanograms[2] (ng) but less than 5 ng of THC per millilitre (ml) of blood (a less severe summary conviction offence);
- 5 ng or more of THC per millilitre of blood (a summary conviction offence of a more serious indictable offence); and
- 2.5 ng/ml of THC combined with 50 mg/dl of alcohol.

The 2018 amendments also provided the police with the authority to demand drivers suspected of having a drug in their body to provide a sample of oral fluid to enable a proper analysis to be made using approved drug screening equipment (ADSE). The officer can also require drivers to submit to a Standardized Field Sobriety Test (SFST), participate in an evaluation of drug influence by an officer trained in the Drug Evaluation and Classification (DEC) Program (known as a Drug Recognition Expert or DRE) and provide a sample of blood to determine the type and concentration of drugs in the person's body.

[1] In addition to cannabis, there are nine other substances for which there are blood drug concentration values prescribed in the regulations. For most of these substances (e.g., lysergic acid diethylamide [LSD], phenylcyclohexyl piperidine [PCP], cocaine, methamphetamine) the threshold is "any detectable level." The level for gamma hydroxybutyrate (GHB – a depressant drug) is set at 5 mg/l of blood.

[2] A nanogram (ng) is one-billionth of a gram.

The Standardized Field Sobriety Test (SFST) consists of a set of three tests: walk-and-turn, one-leg stand, and an examination of eye movements known as nystagmus. This set of tests provides validated evidence of impairment and is widely used throughout Canada, the United States and several other countries around the world.

A Drug Evaluation and Classification assessment involves a systematic and standardized 12-step procedure to assess the common effects associated with various classes of drugs. It concludes with the demand for a sample of blood, urine or oral fluid for toxicological testing for drug content. Refusal to comply with any of these demands is a Criminal Code offence with penalties that are equivalent to those for an impaired driving conviction.

Prevalence of Cannabis Use and Driving

Data from the National Cannabis Survey reveal that following the legalization of nonmedical cannabis in 2018, 13.2% of survey participants with a driver's licence who use cannabis admitted driving within two hours of using cannabis at least once in the previous three months (Rotermann, 2021). This was a modest decrease from the 14.2% who reported doing so before legalization. Riding as a passenger in a vehicle operated by someone who had consumed cannabis in the previous two hours also decreased – from 5.3% before legalization to 4.2% after (Statistics Canada, 2019). These latter data show that the risks are not restricted to those who drive after using cannabis but extend to those who choose to ride with these drivers as well.

Random roadside surveys collect breath and oral fluid samples from drivers on the road at night, providing objective data on the extent of alcohol and drug use. In a compilation of data from such surveys in five provinces and territories between 2016 and 2018, 4.4% of drivers were found to have been drinking, and 7.6% tested positive for cannabis. Drivers aged 25 to 34 years were most likely to have been drinking (5.1%). Those aged 20 to 24 years were most likely to test positive for cannabis (12.7%). Males were twice as likely as females to test positive for cannabis (9.4% and 4.7%, respectively) (Canadian Council of Motor Transport Administrators, 2019).

After alcohol, cannabis is the most frequently detected substance among drivers arrested for impaired driving. In a review of more than 5,000 blood and urine samples collected from suspected impaired drivers in Ontario and submitted to the Centre of Forensic Sciences for analysis between 2008 and 2019, cannabis was found more than half (52.8%) of all cases. Males and drivers aged 15 to 25 years were most likely to test positive for cannabis (Beirness et al., 2021).

Cannabis use is common among drivers involved in collisions. In two studies of drivers treated at trauma centres in British Columbia for injuries sustained in motor vehicle collisions, blood samples were analyzed for THC, alcohol and other substances. The first of these studies found 7.3% of drivers tested positive for THC (Brubacher et al., 2016). The second reported 8.3% were positive for THC (Brubacher et al., 2019).

An examination of fatally injured drivers in Canada between 2000 and 2010 revealed that 16.6% of those tested were positive for cannabis (Beirness et al., 2013). During this time, only about half of all fatally injured drivers were tested for drugs. Between 2011 and 2014, drug testing rates increased substantially. In 2014, 81.9% of fatally injured drivers were tested for drugs, and 18.9% of those tested were positive for THC (Brown et al., 2017). More recently, data from Ontario indicated that the number of cases testing positive for cannabis exceeded that of cases positive for alcohol (Beirness et al, 2022). Crashes involving a driver impaired by alcohol were most likely to have occurred on a weekend and involved a single vehicle. However, crashes involving a driver impaired by cannabis were more evenly distributed throughout the week and more likely to have involved more than one vehicle.

Effects of Cannabis on Driving Performance

Numerous studies have assessed the nature and extent of the effects of cannabis on a wide variety of cognitive and motor tasks (e.g., Ashton, 2001; Berghaus & Guo, 1995; Hartman & Huestis, 2013; Hartman et al., 2015; Marcotte et al., 2022; Ramaekers et al., 2000). Performance deficits have been found in tracking, reaction time, visual function, concentration, short-term memory and divided attention. Studies of driving performance (both simulated and on-road) showed increased variability in lateral position in the lane, following distance and speed as a result of cannabis use. Cannabis also impairs performance on divided attention tasks — those tasks that require the ability to monitor and respond to more than one source of information at a time. Cannabis also compromised the ability to handle unexpected events, such as a pedestrian darting out on the roadway.

Combining cannabis with even small amounts of alcohol greatly increased the negative effects on driving skills (Downey et al., 2013; Hartman et al., 2015; Ramaekers et al., 2000). Although it is common to find drivers who have used cannabis in combination with other drugs

(e.g., cocaine), the effects of such drug combinations and their interactions have not been the subject of considerable research.

Among the effects of cannabis reported across various studies, a common finding is increased variability in performance. Although some of this variability can be attributed to differences in study design (e.g., cannabis dose, sensitivity of the task or equipment, time after smoking), there also appears to be considerable variability among individuals (Hartman & Huestis, 2013). Whereas some people may show substantial impairment after relatively small amounts of cannabis, others show only moderate effects after the same dose. These differences may be related to task skill, prior experience with cannabis, the usual dose and frequency of cannabis use, and route of administration. These differences make it somewhat difficult to predict the extent to which a given amount of cannabis will have an effect on a particular individual.

The weight of evidence clearly reveals significant psychomotor impairment as a result of cannabis use. Individuals with more experience in using cannabis may be more aware of their intoxication and impairment, and attempt to compensate for it by using behavioural strategies, such as slowing down, increasing headway and reducing risk-taking behaviours (Smiley, 1986). However, these tactics may not sufficiently compensate for all the impairing effects of cannabis — especially unexpected events and higher-order cognitive functions, such as divided attention tasks and decision making. Attempts to compensate may be at the expense of vehicle control — for example, speed control, lane position variability, reaction time — reflecting deficits in the ability to allocate attention. Individuals who regularly use cannabis my also develop a degree of tolerance to the effects of the drug and may display less impairment than people with less experience (Ramaekers et al., 2009). However, tolerance does not necessarily develop to all drug effects at the same time nor does it completely eliminate all performance deficits. Moreover, if cannabis use is no longer producing the same effects as a consequence of acquired tolerance, the person is likely to increase the dose of cannabis to reinstate the desired effects.

The Risk of Collision After Using Cannabis

Several studies have examined the risk of crash involvement associated with cannabis use by comparing the extent to which drivers who have used cannabis are overrepresented in collisions compared to drivers who have not used cannabis. The estimates of increased risk associated with cannabis use vary considerably among studies, with some showing no increase in risk (e.g., Lacey et al., 2016) and others reporting a 14-fold increase in the risk of crash involvement (Kuypers et al., 2012). Using blood THC concentrations of 5 ng/ml and more as a criterion for acute cannabis impairment, Gjerde and Mørland (2016) determined that there were only three studies that provided evidence of the increased risk of crash involvement associated with acute cannabis intoxication (Drummer et al., 2004; Laumon et al. 2005, Kuypers et al., 2012). These studies report increases in the risk of crash involvement of 2 to 14 times higher than that of drivers not impaired by alcohol or drugs. Different criteria were used to select studies for inclusion, so the results and conclusions of the three studies differ somewhat. The greatest increases in risk were associated with higher quality studies and studies of fatal crashes.

The research shows that drivers who have been using cannabis with alcohol are at significantly greater risk of collision (Brault et al., 2004; Drummer et al., 2004; Longo et al., 2000; Williams et al., 1985).

Identifying Drivers Impaired by Cannabis

The detection and assessment of cannabis use among drivers are considerably more complex than for alcohol. Whereas most people are familiar with the usual signs and symptoms of alcohol intoxication (e.g., smell of alcohol, bloodshot eyes, slurred speech, motor inco-ordination), the same is not necessarily true for cannabis. However, drivers who have been using cannabis often display one or more signs of use. These can include a distinct smell of cannabis in the vehicle or on the person, dilated pupils, lapses of attention and concentration, and bloodshot eyes. These signs are often sufficient for police officers to form a reasonable suspicion that the driver has a drug in their body, which allows them to proceed with a demand for the driver to perform the three tests of the SFST (see textbox on page 3), provide a sample of oral fluid to be screened at roadside using ADSE or both.

Drivers who demonstrate impaired performance on the SFST or have a positive drug screen can be required to accompany the officer for evaluation by an officer trained in the DEC program. (See textbox on page 3.) The purpose of the procedure is to provide the officer with the necessary evidence to determine whether the suspect is impaired, whether the observed impairment is due to drugs and which category or categories of drugs are most likely responsible for the observed impairment. Trained officers can identify the class of drugs responsible for the impairment with an accuracy rate of 95% (Beirness et al., 2009).

Since it was first introduced over 30 years ago, the DEC program has grown substantially and is being used in all 50 U.S. states. The DEC program was implemented in Canada in 1995. In 2008, new legislation made it mandatory for drivers suspected of drug use to participate in a drug evaluation, thereby providing the police with the tools required to aid in the detection and arrest of drivers whose ability to operate a vehicle is impaired by cannabis.

Cannabis has a unique DEC profile that includes poor co-ordination and balance, reduced ability to divide attention, elevated pulse and blood pressure, dilated pupils, inability to cross one's eyes, bloodshot eyes, and tremors in one's eyelids, legs, body or any combination of these. The evaluation concludes with a demand for a sample of bodily fluid (i.e., blood, oral fluid or urine) to be sent to a toxicology lab for analysis. The results of the DEC evaluation, when combined with the findings from the toxicological analysis of the sample, are generally sufficient to proceed with impaired driving charges.

Penalties for Drug-Impaired Driving

Drivers convicted of an impaired driving offence involving either alcohol or drug(s) are subject to the same penalties. A first offence carries a fine of not less than $1,000, a mandatory driving suspension of one to three years and a possible jail sentence of up to two years. A second offence leads to a mandatory minimum of 30 days in jail and minimum two-year suspension from driving. For third and subsequent offences, the penalty is imprisonment for a minimum of 120 days plus a minimum three-year driving prohibition. Impaired drivers who cause injury or death face longer periods of incarceration, including imprisonment for life.

In addition, provincial and territorial licensing authorities often impose longer periods of suspension for an impaired driving conviction and may require offenders to complete an assessment of alcohol, drugs or both; participate in an ignition interlock program; attend an educational program; participate in a rehabilitation program; or any combination of these.

Many provinces authorize the police to impose an immediate short-term licence suspension and vehicle impoundment for driving after drug use, poor performance on the SFST or a positive drug screen. In most cases, these administration sanctions are equivalent to those for driving with a blood alcohol concentration of at least 50 mg/dl and may also include fines, recording the suspension on the driver's record and escalating sanctions for repeat violations (Canadian Centre on Substance Use and Addiction, 2021). Most jurisdictions have also implemented zero tolerance for alcohol and drugs for novice or young drivers.

Conclusions and Implications

Drivers who have used cannabis are common on Canada's roadways. In fact, cannabis use by drivers exceeds that of alcohol among nighttime drivers and is among the most frequently found drugs in drivers involved in serious crashes.

The incidence of driving after cannabis use, particularly among young people in Canada, may be attributable in part to them not necessarily perceiving their driving ability to be adversely affected. In addition, many young people often believe that it is difficult for police to detect and charge drivers for driving while impaired by cannabis (McKiernan & Fleming, 2017; Porath-Waller et al., 2013). Such beliefs are unfounded and greater (and sustained) efforts must be made to ensure drivers understand the risks associated with driving after using cannabis.

There is much to be learned from years of efforts to reduce drinking and driving. However, societal attempts to control driving after cannabis use must recognize the substantial differences that exist and develop innovative and comprehensive approaches to deal specifically with this issue. Such approaches require a combination of research, prevention, enforcement, treatment and rehabilitation. Research is needed to provide estimates of the magnitude and characteristics of the problem (Meister & Drug-Impaired Driving Indicators Advisory Committee, 2022) and greater understanding of the factors contributing to the behaviour. Awareness and education programs need to be developed for both the general population and specific high-risk groups — such as youth — to provide factual information and dispel common myths. Schools, driver licensing offices and driver education programs are among the potential targets for the implementation of such prevention activities.

Assessment and rehabilitation programs also play a role in an overall strategy. For those convicted of drug-impaired driving, the extent of their drug use should be assessed and, where warranted, treatment and rehabilitation programs made available to help ensure the behaviour does not recur or escalate. Together, these elements can be integrated to create a comprehensive and effective response to the issue of driving while impaired by cannabis.

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