Investigating Higher-Risk Use and Impaired Driving: Development and Implementation of the Cannabis Legalization Impact Questionnaire (CLIQ)

By

Matthew R. Labrecque

A Thesis Submitted to

Saint Mary's University, Halifax, Nova Scotia

in Partial Fulfillment of the Requirements for

the Degree of Master of Science in Applied Psychology (Forensic Psychology)

March 2024, Halifax, Nova Scotia

© Matthew R. Labrecque, 2024

Approved: _____

Marc Patry, PhD

Supervisor

Approved: _____

Marguerite Ternes, PhD

Committee Member

Approved: _____

James Cameron, PhD

Committee Member

Approved: _____

Chris Giacomantonio, PhD

External Examiner

Table of Contents

List of Tables

List of Appendices

List of Acronyms

O1-HCU: Higher-Risk Cannabis Use Behaviours

O2-ID: Impaired Driving Behaviours

O3-IR: Impaired Riding Behaviours

P1A-CR: Cannabis Regulation Attitudes

P1B-RCR: Relative Cannabis Risk Attitudes

P2A-GP: Government Preparedness Attitudes

P2B-LP: Law Enforcement Preparedness Attitudes

P2C-LIP: Law Enforcement Cannabis-Impaired Driving Preparedness Attitudes

P2D-LIR: Law Enforcement Cannabis-Impaired Driving Recognition Attitudes

P3-DL: Drug Legalization Attitudes

P4-KS: Knowledge Source Attitudes

P5A-PCU: Personal Problematic Cannabis Use Attitudes

P5B-PAU: Personal Problematic Alcohol Use Attitudes

P6-ID: Impaired Driving Dangerousness Attitudes

P7-IP: Impaired Driving Personal Ability Attitudes

P8-IA: Impaired Driving Acceptability Attitudes

Abstract

Investigating Higher-Risk Use and Impaired Driving: Development and Implementation of the Cannabis Legalization Impact Questionnaire (CLIQ)

By Matthew R. Labrecque

In 2018, Canada became the second country in the world to legalize recreational cannabis. As legalization plays out, investigation of changes in public health outcomes related to cannabis use and impaired driving is required. The current thesis aimed to identify groups, attitudes, and behaviours related to cannabis-related risks, and determine if prevalence of higher-risk behaviours changed after legalization. An online survey of behaviours, attitudes, and demographics was developed and completed by 608 post-secondary students. Comparative analysis showed relations between attitudes and higher-risk behaviours exist, including associations between impaired driving attitudes and cannabis-impaired driving behaviours. Regression analysis accurately predicted higher-risk cannabis use and impaired driving behaviours. Novel cannabis-related attitudes were predictive of higher-risk behaviours and in some cases more predictive than demographic variables. Analysis of variance revealed that changes in higher-risk behaviours occurred after legalization, but no significant increases were identified. Implications for researchers, law enforcement, policymakers, and consumers are discussed.

March 8th, 2024

Investigating Higher-Risk Use and Impaired Driving: Development and Implementation of the Cannabis Legalization Impact Questionnaire (CLIQ)

Canada is the second country in the world to legalize cannabis, as of October 17, 2018, with the enactment of Bill C-45 (*Cannabis Act*; House of Commons of Canada, 2017). The Cannabis Act aimed to "create a strict legal framework for controlling the production, distribution, sale, and possession of cannabis across Canada" (House of Commons of Canada, 2017). The three main goals of the Act are to keep cannabis out of the hands of youth, keep profits out of the pockets of criminals, and protect public health and safety by allowing adults access to legal cannabis (MacKay et al., 2017). Historically, Canadians, especially Nova Scotians, have concerningly high rates of cannabis use and cannabis-related risks such as daily use and driving under the influence of cannabis (Fischer et al., 2020; Rotermann, 2020). Public health impacts of cannabis are potentially less severe than those of tobacco or alcohol, but cannabis-related risks still present a significant burden to public health and safety (Fischer et al., 2016).

Canada's high prevalence of cannabis-related risks suggests achieving the goals of the Cannabis Act will not be easy (Solomon et al., 2018). Before legalization, over half of Canadians (59%) supported the legalization and regulation of cannabis, but many citizens still expressed concerns about potential increases in related risk (Forum Poll, 2015). As legalization plays out, legislators and law enforcement strive for an appropriate balance between public safety and individual rights, making assessment, evaluation, and research on relevant public health outcomes imperative. Many important topics are understudied at present, such as cannabis-related attitudes and patterns of impaired driving use, leaving policymakers with a lack of

meaningful data to aid their public health response efforts (Fischer et al., 2017; Lazor et al., 2022).

The present thesis aims to explore cannabis-related outcomes by collecting three phases (pre-legalization, post-legalization/mid-Covid-19, and post-legalization/post-Covid-19) of behavioural and attitudinal data. We hope to contribute to a growing body of research looking to produce a full picture of the true effects of licit cannabis on related risks within the Canadian population, specifically in the province of Nova Scotia. Examinations of cannabis risks, such as pre- and post-use and driving prevalence, have been considered on the surface and found mixed results (Callaghan et al., 2019; Fischer et al., 2022; Hall et al., 2023; Rotermann, 2020). By investigating risks such as behaviours and attitudes related to cannabis use or impaired driving, the present study intends to provide a detailed account of Nova Scotian cannabis-related risks. The introduction relays the legal history of cannabis followed by a literature review of relevant cannabis research.

History of Cannabis Legality

Cannabis is one of the most widely used recreational drugs in the world, especially in North America and high-income European countries (United Nations Office on Drugs and Crime, 2020). Despite the drug's popularity, the legality of cannabis use is varied among different countries and jurisdictions, with most countries not allowing recreational use or personal possession. Uruguay and the United States of America (USA) are prominent examples of countries making early efforts within their legal systems to accommodate cannabis, besides Canada.

Cannabis in Uruguay

Cannabis use has not been a crime in Uruguay since 1974, and the South American country became the first in the world to regulate and legalize cannabis, in 2013 (Pardo, 2014; Queirolo, 2020). The approach to cannabis legalization in Uruguay differs from North American regulatory practices (Cruz et al., 2018; Pardo, 2014). For instance, the Uruguayan government implemented regulations for cannabis cultivation within homes and for the formation of social clubs organized around use and growing. Further, cannabis retail is done through pharmacies across Uruguay in which those looking to buy must register with the government and choose a single method of acquiring their cannabis (retail or homegrown). Uruguayan legislators outlined that a consumer must be at least 18 years old, and each household may grow up to six plants (Cruz et al., 2018).

Legalization in Uruguay contrasts Canadian regulations, such that Canada does not require consumer registration or involvement in growing cannabis. As well, Canadian retail of recreational cannabis does not include distribution through pharmacies. Beliefs towards cannabis legalization also differ across countries, as the majority of Uruguayans were not in favour of their government's legalization and regulation laws (Cruz et al., 2018; Pardal et al., 2019). This contrasts attitudes in North America, where most people support progressive cannabis policies, such as decriminalization or legalization (Pardo, 2014), although meaningful research on user attitudes towards cannabis legalization and harms is lacking (Forum Poll, 2015; Leung et al., 2018).

Cannabis Internationally

The United States of America has not legalized recreational cannabis on a federal level (Chiu et al., 2021). Despite this, many states in the USA currently have legislation detailing

legalized recreational and medical cannabis use, varying levels of decriminalized cannabis laws, or medical cannabis laws. Progressive cannabis laws in the USA emerged mostly in the 2010s with Colorado and Washington states legalizing recreational use in 2012, followed by many more in the decade to follow (Hall & Lynskey, 2020). Variance exists in regulatory approaches between legal-use states, while commonalities include regulations that only Americans aged 21 or older are allowed to purchase, possess, and consume cannabis, typically attained through a retail distributor or medical prescription.

Various countries outside of North America have moved towards progressive policies, adjusting cannabis law to their regional circumstances (Decorte et al., 2020), typically justified by risk-reduction strategies claiming to improve public health. There exists federally decriminalized cannabis use in the Netherlands (in licensed “coffee shops”), decriminalized use (but not sale) in areas of Australia, and decriminalization in Jamaica (although legal for religious use among Rastafari) (Hanson, 2020; Hughes et al., 2017). Many other developed countries around the world have decriminalized cannabis use to varying degrees, including Switzerland, Belgium, and Israel (Hughes et al., 2017).

Cannabis in Canada

Cannabis legalization in Canada is the most comprehensive in the world (House of Commons of Canada, 2017; Hughes et al., 2017; MacKay et al., 2017, Pardo, 2014). Compared to Uruguay and legal-use American states, the federal framework for cannabis legislation in Canada contains extensive legal detail. This is true regarding the regulation of cannabis products and retail, as well as freedom of consumption, with the federal government being responsible for backend aspects of legal cannabis functioning (MacKay et al., 2017). These aspects include

health warnings, analytical testing, licensing, and taxation (shared with provinces and territories), as well as product labelling, marketing, and advertising restrictions.

Goals of Legalization in Canada

Federal legislation outlines various outcomes meant to occur in conjunction with the legalization and regulation of cannabis. Specific strategies and goals for legalization were prepared via subject matter experts throughout the course of legislation planning, with the main purpose of protecting public health and safety. Overall goals cover the areas of health, law, and economics (House of Commons of Canada, 2017). Responsibility to meet these goals is shared by all levels of government.

Certain legal responsibilities regarding consumption and production regulations are decided by federal, provincial, territorial, and municipal governments (House of Commons of Canada, 2017). The federal government has set minimums for legal aspects such as consumption age (18-years-old), the number of cannabis plants allowed per household (four plants), the limit of THC in blood while driving (2 nanograms (ng) per millilitre), where cannabis can be used (no inherent restrictions, federally), how cannabis can be transported in vehicles (no inherent restrictions, federally), and maximum home possession limits (no inherent restrictions, federally).

Regulation Approaches

Provincial and municipal governments can amend federal limits in the case they make these minimums stricter, as many provinces have done (House of Commons of Canada, 2017). For instance, Alberta is the only province to maintain the legal age minimum of 18-years-old, while the rest of Canada has opted to raise the legal age to at least 19-years-old, with Quebec raising it even higher to 21-years-old. Manitoba and Quebec are currently the only two provinces

to not allow cannabis plants to be grown indoors, within households. Quebec is also the only province to not allow outdoor growing at home. Personal home storage limits have also been added in British Columbia, Nunavut, and Quebec, at 1000, 150, and 150 grams respectively. Certain provinces have made it illegal to use cannabis in public, including Manitoba, New Brunswick, Newfoundland and Labrador, Prince Edward Island, Quebec, Saskatchewan, and the Yukon. The rest of the provinces and territories allow cannabis to be used in public either where tobacco may be used or in permitted outdoor public areas such as parks or trails (House of Commons of Canada, 2017).

A large part of cannabis legalization is the retail of cannabis products. Provinces such as Alberta, Ontario, and British Columbia allow for private retailers to sell cannabis products, while Nova Scotia, New Brunswick, and Prince Edward Island only permit government-run retailers to sell cannabis products. Online sales for all provinces, except Saskatchewan and Manitoba, are government-run (House of Commons of Canada, 2017). The transportation of cannabis in motor vehicles also differs between provinces. Quebec and New Brunswick have no restrictions, while all other provinces have different combinations of regulations relating to proof of legal purchase, proper storage of cannabis products, and the distance the cannabis is from the driver or passengers (House of Commons of Canada, 2017). Different provinces and territories have their own laws with varying strictness regarding legal aspects of cannabis, but in general, Canada has the most homogenous, progressive, and comprehensive cannabis regulations worldwide. Early into legalization, Canada's informed effort has been hailed for taking many positive steps, but the general impact of legalization has yet to be established, especially within at-risk jurisdictions and for users engaging in higher-risk use (Hammond et al., 2020).

Provincially Unique Cannabis Risks

Interprovincial differences in legislation exist to address the unique scenario of each province's populace, as provincial governments increase the severity of federal laws to meet the specific needs of each area. Provinces have made decisions based on their regional ideologies and risk factors, resulting in differing approaches to meeting the goals of legislation (Watson et al., 2019). For example, Quebec has some of the strictest provincial cannabis laws, in both retail and use regulations, mirroring Quebecers' lower use rates and negative attitudes towards cannabis. On the other hand, the Alberta government has opted to implement relatively liberal restrictions, in both the retail and use sides of regulation, in part reflecting the province's historically higher rates and acceptance of cannabis use (Watson et al., 2019).

The Nova Scotian government has taken a relatively moderate approach to cannabis regulation. Only government-run storefronts and online deliveries are allowed, placing the province on the tighter end of retail regulation. Personal cannabis use, however, is more liberally legislated as Nova Scotians may grow cannabis at home and use cannabis in public wherever tobacco use is allowed (unless stated otherwise by a business or jurisdiction) (House of Commons of Canada, 2017). Recent research has begun to uncover how varying regulations may differentially influence public health, finding that policies continue to shift as legalization plays out (Gagnon et al., 2022). Considering jurisdictional cannabis regulations when studying the impact of legalization has been highlighted as a key recommendation for future research (Lazor et al., 2022).

Covid-19 and Cannabis

The Covid-19 pandemic has brought forth considerable health concerns, in Canada and across the world (Appleby et al., 2022; Zhu et al., 2020). Measures enacted by governments to

reduce contact rates such as work from home mandates, socialization restrictions, physical distancing, and closure of non-essential businesses were associated with substantial social and economic effects (Holmes et al., 2020). Outcomes such as increased loneliness, stress, and anxiety may lead to increased higher-risk cannabis use (Elton-Marshall et al., 2020). In some cases, increased cannabis use during Covid-19 has been found (Imtiaz et al, 2021; Rotermann, 2020; Varin et al., 2021; Yousufzai et al., 2022) and was associated with reporting a decrease in mental health (Rotermann, 2020; Varin et al., 2021). Individuals more likely to increase their cannabis use were of younger age, male, ethnically European, possessed less than a college/university education, engaged in binge drinking, and those whose personal finances were affected by the pandemic (Imtiaz et al., 2021; Imtiaz et al., 2022).

Pandemic effects on higher-risk cannabis outcomes such as daily or almost daily use (DAD) or cannabis-impaired driving (CID) are less clear than the growth in general use among Canadians (Imtiaz et al., 2022). There are currently mixed results regarding whether users have increased harmful consumption of cannabis, with some research finding stable rates of DAD during Covid-19 (Imtiaz et al., 2022) while other research reported jurisdictional-specific increases in DAD rates (Rotermann, 2021). Alcohol use also increased during the Covid-19 pandemic, at almost three times the rate of increased cannabis use (Rotermann, 2020; Varin et al., 2021) with 14-16% of Canadians increasing their alcohol use compared to the 5-7% who increased cannabis use. In contrast to increased cannabis use, older age has been found to be associated with increased alcohol use and no gender has been found to be more likely to report increased alcohol use than the other (Rotermann, 2020; Varin et al., 2021).

Emerging Risk

Escalating use of cannabis and other substances among Canadians is indeed concerning, with recent work finding increased access to cannabis and subsequent increased use of cannabis to be associated with cannabis-attributable emergency department (ED) visits (Kim et al., 2022; Myran et al., 2022). In the province of Ontario, increases in cannabis-attributable ED visits were found to have spiked during the time commercialization of cannabis was introduced and during the Covid-19 pandemic, but not during the initial legalization period (Myran et al., 2022).

Post-legalization, Ontario consumers initially had few options for commercial access to cannabis. Ontario has subsequently increased access in the years since legalization, although still possesses the second lowest number of stores per citizen among provinces, as of 2022. For comparison, Ontario has 1.6 stores per 100,000 people while Alberta, the highest, has 14.3 stores per 100,000 people (Myran et al., 2022). Ontario showed a notable increase in ED visits after only slightly increasing commercial access to cannabis. Jurisdictionally minded research is needed to investigate outcomes related to provincial-specific harm. There exists variation between provinces in access to commercial cannabis, as well as differences like pricing or having a public model versus a private model of sale (Kim et al., 2022; Myran et al., 2022). At-risk provinces like Nova Scotia would benefit from continual, public health-focused, research on localized issues related to cannabis (Gagnon et al., 2022; Myran et al., 2022).

The present thesis intends to help fill this gap in knowledge by surveying Nova Scotians throughout each period of legal relevancy, including pre-legalization, post-legalization, and through the Covid-19 pandemic. This historical recap served to introduce the context of the ongoing legalization process for Canadians across different provinces.

Cannabis Use

There are numerous potential impacts of cannabis legalization; the study at-hand aims to investigate outcomes within scope of the federal goal of ensuring public health and safety. A comprehensive battery surveying the most relevant behavioural, attitudinal, and knowledge indicators of any improvements or declines in the health and safety of Canadians, specifically Nova Scotians, was created (and is detailed after the Introduction). The following section reviews pertinent cannabis-related research. Survey content and analytical strategies are derived from leading initiatives, such as the Lower-Risk Cannabis Use Guidelines (LRCUG; Fischer et al., 2011; 2021). Research considering understudied measurements of psychological impacts related to cannabis legalization, are also detailed (Lazor et al., 2022). Table 1 presents eminent surveys used in literature and their intended use, to help bring the present thesis' survey into conceptual scope. These surveys and measures include the Lower-Risk Cannabis Use Guidelines (LRCUG; Fischer et al., 2011, iCann Toolkit (Schluter & Hodgins, 2022), Canadian Cannabis Survey (CCS; Health Canada, 2022), National Cannabis Survey (NCS; Statistics Canada, 2022), Canadian Alcohol and Drugs Survey (CADS; Health Canada, 2019), and Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS; Health Canada, 2019).

Table 1

Eminent Cannabis Measures Review

Measure	Target Use
LRCUG	Use guide based on adverse factors that modify risk
iCann	Universal/self-report/biological measure of use
CCS	Capture habits of users/behaviours relative to use
NCS	Measure habits of users/purchasing
CADS	Detail general public use
CSTADS	Monitor use, in school-aged youth

Prevalence of Cannabis Use

An important, post-legalization public health metric is if the prevalence of cannabis use changes among the general population. Cannabis use is a crucial base measure given consumption is a prerequisite for any possible cannabis-related risk and harm (Fischer et al., 2017). Although causality cannot be determined, research from the USA comparing legalized states to states without legalization found higher rates of cannabis among populations in legalized states (Hasin et al., 2015; Stolzenberg et al., 2016).

Over the past three to four decades in Canada, adults have reported increasing rates of cannabis use; for instance, 7% reported past-year use in 1994 which increased to 14% in 2004 (Rotermann & MacDonald, 2015). Prevalence mostly stabilized in the 2010s, with Canadian adult rates of cannabis use hovering around 15% just before legalization in 2018 (Rotermann, 2019). Initial reports from post-legalization prevalence research, collected in 2019, found 17% of Canadians reported using cannabis in the past three months, an increase from a reported 15%, in 2018 (Rotermann, 2020). Past 30-day use prevalence was also found to have increased 2% among Canadians, from pre-legalization in 2017 to post-legalization in 2019 (Pham et al., 2022). The age group with the highest rates of cannabis use are 18- to 24-year-olds, reported at a consistent 33% during the late 2010s. No matter the age group, males consistently report higher rates of cannabis use (~17-20%) than females (~12-14%) (Rotermann, 2019; 2020).

Age of first initial cannabis usage is a crucial measure for examining public health consequences of legalization (Fischer et al., 2017). Beginning cannabis use at an early age, especially during teenage years, is strongly predictive of cannabis-related risk outcomes, such as future severe and/or chronic issues with mental health, lowered educational outcomes, and reduced brain functioning (Camchong et al., 2017; Jacobus & Tapert, 2014; Volkow et al.,

2014). Adding to the concern of a potential increase in youth usage, data on cannabis use in post-legalization American states have shown increased rates of cannabis use among young people (Maxwell & Mendelson, 2016). Conversely, there exists encouraging research that found a decrease in cannabis use among young Canadians post-legalization (Rotermann, 2020), finding a decrease in past three-month use from 20% to 10% from 2018 to 2019. More data on post-legalization cannabis use is required given Canadians' novel experience with the national legalization of cannabis, in addition to the Covid-19 pandemic.

Nova Scotians have been found to report the highest rate of past three-month cannabis use in Canada, at 26% (Rotermann, 2020), and are the focus of this study. The province of Nova Scotia has shown a marked increase in use prevalence in recent years, continuing to lead the way for the highest in Canada, after legalization (Rotermann, 2019; 2020). In comparison, Quebec consistently reports the lowest rates of cannabis users in Canada, at around 12% (Rotermann, 2020). According to numerous metrics and data sources, Nova Scotians are more likely to use cannabis at higher rates, as well as engage in higher-risk cannabis-related behaviours, compared to other provinces.

Patterns of Cannabis Use

As overall prevalence increases so does the risk for cannabis dependence and an array of problematic patterns of cannabis use (Fischer et al., 2022). Certain cannabis usage patterns have been found to predict various chronic and acute risks in users, such as binge using and intense habitual patterns (Hall & Degenhardt, 2009; Marconi et al., 2016).

Daily (or Almost Daily) Use. Daily (or almost daily) use (DAD) and other intense or frequent use patterns are related to an increased risk for dependence, lowered mental health, decreased brain functioning, and numerous other mental and physical risks (Batalla et al., 2013;

Lorenzetti et al., 2015). Concerningly, the number of DAD users increased drastically in the last two decades, and currently around 6% of Canadians use cannabis daily or almost daily (Azofeifa et al., 2016; Rotermann, 2020). DAD users are most consistently found to be 18- to 44-years-old and male, with prevalence rates of this demographic remaining stable over the past decade (Rotermann, 2019; 2020). More specifically, young people (15- to 24-year-olds) report the highest rates of both overall and DAD use, compared to individuals aged 25 and older (Fischer et al., 2022).

Nova Scotia has the highest rate of DAD use among all provinces at 10%, 4% higher than the Canadian national average of 6%, and much higher than Quebec which reports the lowest provincial DAD rate at around 3% (Rotermann, 2020). Cannabis legalization researchers suggest that an increase in availability and normalization of use may lead to an increase in problematic use patterns and related risks (Hall & Weier, 2015). DAD and other patterns of use stand as important indicators of public health to track.

Cannabis Use Disorder. Cannabis-related risks and harms are experienced most often by daily (or almost daily) users, especially those with cannabis use disorder (CUD) (Fischer et al., 2022). CUD is defined by the American Psychiatric Association (APA) as "problematic cannabis use leading to clinically significant impairment or distress manifested by impaired control, continued use despite social/medical problems, craving, tolerance, and withdrawal" (American Psychiatric Association, 2013). CUD is measured via standardized diagnostic assessments and may require professional mental health treatment (Copeland & Swift, 2009).

Recent research on CUD prevalence estimates almost a third of cannabis users may develop CUD, an increase from reports in the 2000s that suggested around 10% of cannabis users would eventually develop CUD (Hasin et al., 2015). CUD is a severe mental health

outcome related to cannabis use and the most problematic pattern of use, leading an increasing number of Canadians to seek treatment to address their cannabis misuse (Fischer et al., 2017). Nova Scotia saw a 50% increase in treatment admissions related to CUD from 2009 to 2012 (Cooke et al., 2020). Nova Scotian rates of CUD, and closely related patterns such as DAD use, require investigation to better understand how legalization may have played a part in any changes and how public health initiatives can best respond to potentially growing rates of risks.

Modes of Consumption

Modes of use refer to the physical method used to consume cannabis, such as smoking a rolled joint, using a bong, or eating an edible. The number of modes has increased drastically in the past decade and even more after legalization, with innovation in both inhalation and non-inhalation modes of use (Russell et al., 2018). An example of alternative inhalation modes are vaporizer devices that allow the user to consume cannabis flower or concentrate, whereas examples of a non-inhalation-based mode of use are THC-infused edibles (such as brownies and cookies) or beverages (Borodovsky et al., 2016; Schauer et al., 2020).

Despite the availability of alternative methods of cannabis consumption, smoking cannabis is currently, and has long been, the most common mode of use (Singh et al., 2016; Wadsworth et al., 2022). Although widely prevalent, smoking is known as a higher-risk method of using cannabis and is related to numerous health harms such as bronchial and pulmonary issues, as well as lung cancer (Hashibe et al., 2006; Khalid et al., 2014). Recent research shows an encouraging downwards trend, as less users are choosing to smoke dried flower, with edibles and vaporisers being the most commonly used alternative methods, although jurisdictional differences remain mostly unexplored (Hammond et al., 2022). Smoking is well-recognized as a harmful method of cannabis use, but it may be too early to recommend specific new modes of

use as completely safe alternatives to smoking, given the lack of long-term research on the use, especially for vaporizing (Fischer et al., 2022; Russell et al., 2018). Regardless of the uncertainty of the healthiest method to consume cannabis, modes of use remain a useful indicator of public health.

Potency and Price of Products

The potency of the cannabis that Canadians use is vital to investigate given the increasing availability of high tetrahydrocannabinol (i.e., THC – the psychoactive compound in the cannabis plant) products (ElSohly et al., 2016). This increase is concerning given high THC cannabis use is associated with an increased risk for a psychotic disorder, decreased mental health, and other negative health outcomes (Di Forti et al., 2015; Ramaekers et al., 2021). Further, THC concentrate products with very high THC potencies (up to 80-90%) are growing in popularity (Raber et al., 2015). Levels of THC in cannabis flower products have been gradually increasing for decades (ElSohly et al., 2016), from an average of around 4% THC in cannabis flower during the mid-90s, to around 12% by the start of the 2010s, up to around 16% by the 2020s (Leos-Toro et al., 2020). Cannabis strains with other high potency cannabinoid aspects, such as cannabidiol (CBD), are also increasing (Leos-Toro et al., 2020).

Researchers have noted the potential for CBD to have antipsychotic effects which may moderate risks associated with increased THC levels (DiForti et al., 2019; Iseger & Bossong, 2015). Despite this, many users are not aware of the THC or CBD content of the products they purchase (Hammond & Goodman, 2022). Cannabis users may not be currently following evidence-based recommendations regarding high THC and CBD product usage, rendering usage and knowledge of product types a worthwhile public health variable for consideration. Regarding retail cost, dried flower prices have decreased since legalization and an increasing proportion of

users are purchasing from legal sources; however, jurisdiction specific concerns may exist and require further research (Wadsworth et al., 2022).

Poly-Substance Use

Along with concerns of increased cannabis-related harms, legalization may bring about a complimentary increase (or decrease) in problematic use of other substances (Lee et al., 2020). Comorbid use of cannabis and alcohol or tobacco is common and any concurrent increases in using these substances bring about concerns of increased risk to public health (Windle et al., 2019). In terms of potential for favourable substance use trends, limited research from the USA has reported that legalization, and subsequent increased access to cannabis, are associated with a decrease in opioid-related harms (Livingston et al., 2017). The resulting changes in numerous drug use trends is an important indicator to research, given the potential for negative and positive public health consequences following legalization.

Cannabis as a Gateway Drug

Of long-time debate among research and policymaking circles is whether cannabis is a "gateway drug". Evidence of cannabis being a gateway drug, such that cannabis use is related to or leads to other drug use (such as cocaine, opioids, or methamphetamines), is mixed and controversial (Wilson et al., 2022). Cannabis use is uniquely and strongly associated with other drug use, including problematic opioid use (Fergusson et al., 2006; Hasin et al., 2017; Olfson et al., 2018).

There is ample evidence of a relationship between cannabis use and other drug use, but the direction and strength of this relationship is not reliably understood, given the diverse contexts of cannabis use, and confounding genetic and environmental factors (Agrawal et al., 2004; Nkansah-Amankah & Minelli, 2016; Wilson et al., 2022). Findings suggest that early or

regular cannabis use may lead to changes in brain function that increase the likelihood of other drug use, but further research is needed (Balon, 2020; Hall & Lynskey, 2009; Williams, 2020).

Impaired Driving

Cannabis-Impaired Driving

Cannabis-impaired driving (CID) is a criminal offence in Canada (House of Commons of Canada, 2017) and associated with increased risk for motor vehicle accidents (MVAs) and resulting fatalities (Hartman & Huestis, 2013; Rogeberg & Elvik, 2016), especially among young people (Goodman et al., 2020). CID is one of the only cannabis-related behaviours that may directly lead to loss of life (Wettlaufer et al., 2017).

Given the severe impact of MVAs and related fatalities, a potential increase in CID is one of the main concerns surrounding cannabis legalization (Hammond et al., 2020; Perreault, 2016). Post-legalization data from legal American states have found increased instances of CID-related MVAs and injuries (Steinemann et al., 2018). Further adding to worries, Canadian police data shows that drug-impaired driving incidents almost tripled from 2009 to 2018 (Moreau, 2019). Moreover, despite higher rates of drug-driving, Nova Scotia courts had the lowest percentage of drug-impaired driving cases resulting in a guilty verdict in all of Canada (Perreault, 2016).

Prevalence of Cannabis-Impaired Driving

From the 1990s to mid-2010s, CID rates were gradually increasing (Rotermann, 2020). Improvements in the police's ability to detect and report CID may have partly influenced reporting numbers during this time (Rotermann, 2018), though it is possible these rates increased alongside general use prevalence. To combat CID, new laws in Canada have been enacted enabling police officers to demand a suspected impaired driver complete the Standard Field

Sobriety Test (SFST) and potentially provide an oral fluid sample that detects THC presence (MacKay et al., 2017).

Before legalization, research reported that among Canadians who had used cannabis in the past year, approximately 39% had driven while intoxicated from cannabis use (Perreault, 2016; Rotermann, 2020). Initial post-legalization reports indicate the rate of past-year user CID has dropped to 34% (Goodman et al., 2020), although these rates are constantly changing as policy and law evolve. Presently, true changes in CID since legalization are difficult to discern due to limited data (McDonald et al., 2021). Early post-legalization data suggest that the post-legalization rate of CID for past three-month users has remained similar to the pre-legalization rate of about 13% (Rotermann, 2020). CID rates in the general population are much lower at about 3%, with young people (ages 16-30) reporting the highest rate at 9% (Fischer et al., 2021).

Canadian cannabis-using women are less likely to engage in CID than males, with recent rates showing a 6% difference in male (15%) and female (9%) rates (Rotermann, 2020). Young cannabis users are of particular concern, with 15% of high school-aged users reporting CID (Asbridge et al., 2012), a rate that increases to around 17% for young adults (ages 16-30) (Goodman et al., 2020). DAD users have been consistently found to be the most likely group to engage in CID (Fischer et al., 2021). Utilizable data on impaired driving behaviour is growing but requires continual consideration to bring forth meaningful recommendations for risk reduction (McDonald et al., 2021).

Riding with a Cannabis-Impaired Driver, as a Passenger

Driving under the influence of cannabis is a serious legal offence and harm to Canadians. In addition, riding with a cannabis-impaired driver (RCID), as a passenger, is a related and important issue, as the potential for harm increases drastically with more lives at stake (Lensch et

al., 2020). RCID has been a concern for Canadians for many years and as with most aspects of cannabis-related harm, it is especially harmful to young people and frequent cannabis users. These two at-risk groups are also the most likely to engage in RCID, with recent research showing a RCID prevalence of 12% among young people (aged 18- to 24-years-old) and 20% among regular cannabis users (Rotermann, 2020).

Females, as with other harmful cannabis-related behaviours, are less likely to report RCID than males. Research on recent changes in rates of RCID suggests prevalence in Canada has decreased overall, from 5% to 4%, attributing this drop to a decrease in female rates of engaging in RCID (Rotermann, 2020). Across Canada, there are varying provincial rates of RCID, but Nova Scotia leads the country with a reported past-year, RCID rate of 6% (Rotermann, 2020). The trend of Nova Scotia consistently reporting the highest national rates of cannabis harm ought not go unnoticed; high rates of DAD, CID, and RCID in Nova Scotia are a reason for concern, and a coordinated effort to prevent potential risk would be beneficial.

Cannabis-Related Attitudes

Current research on cannabis use has focused mainly on prevalence of behaviours like use frequency, CID, and RCID, but the relationships between attitudes toward use, CID, and RCID, (as well as distracted, fatigued, and alcohol-impaired driving), have been understudied despite their theoretical relation to cannabis-related risk and harm (Goodman et al., 2020; McDonald et al., 2021). Growing literature supports the close investigation of attitudes and behaviours related to cannabis use, including in alignment with the Theory of Planned Behaviour (Earle et al., 2020). The theory notes the predictive importance of attitudes such as positive or negative feelings towards, perceived stigma or societal norms, and intentions to engage in certain impaired driving and cannabis-related behaviours (Malmberg et al., 2012). Risky attitudes

towards a substance use behaviour and the likelihood of engaging in such a behaviour has also been clearly outlined in research with substances such as tobacco and alcohol (Bandura, 1986; Wickens et al., 2019). Further investigation into this relationship has been called for, with efforts beginning to emerge in the literature that consider attitude, beliefs, knowledge, and other relevant cognitions related to cannabis uses and harms (Huynh et al., 2021; McDonald et al., 2021).

Emerging Themes Among Canadians

Emerging cannabis-related attitudes can be gleaned from novel and qualitative approaches to research, such as by analyzing Twitter data to identify opinions and themes around cannabis use in Canada throughout legalization (Najafizada et al., 2022). Sentiment and positive polarity analyses revealed seven themes: education/information, uses of cannabis, cannabis products (i.e., packing, quality, price, types, and sources), cannabis policies (i.e., regulations and public safety), access to cannabis, social issues (i.e., gender and stigma), and Covid-19 impacts. Canadian concerns about cannabis should be used to guide future research on public health outcomes, especially those on the minds of the general public (Najafizada et al., 2022).

Current research is looking to understand the evolving perceptions of cannabis, especially on university campuses (Hallet & Chen, 2022). A review of qualitative research of Canadian university students' attitudes, beliefs, and perspectives on cannabis use revealed five themes and common beliefs. These were: "differences between users and non-users are negligible," "expectations of cannabis use are gendered," "cannabis use is influenced by sociocultural networks," "cannabis can be used responsibly or irresponsibly," and "perceived mediating factors in the relationship between students and cannabis use." These findings showed how young Canadians commonly hold beliefs that may lead to lower-risk use of cannabis, as well as beliefs that may lead to harmful behavioural outcomes. This further displays the need for

education and knowledge translation of evidence-informed cannabis information, to address risk and potential harm (Hallet & Chen, 2022).

Attitudes toward Cannabis Use

A scoping review found an absence of expertise in public opinion and political communication relating to public perceptions of cannabis (Cloutier et al., 2022). Theoretical frameworks rooted in social scientists' work is required to measure and understand Canadians' opinions on cannabis in comparison with public policies currently in place (Cloutier et al., 2022). Cannabis users vary in their attitudes regarding harm such as cannabis-impaired driving, harmful use patterns, and CUD, with many cannabis users perceiving use as less risky than non-users do (Cunningham, 2020).

In terms of health risk from using cannabis, Canadians typically agree that CID, use during pregnancy/breastfeeding, and addiction are risks associated with using cannabis (Goodman & Hammond, 2022). Less agreement exists regarding the perception of psychosis and schizophrenia risk that cannabis use may increase (Goodman & Hammond, 2022). In addition, many believe unsubstantiated claims regarding health benefits for cancer treatment and prevention, especially among already problematic users (Cloutier et al., 2022; Hallet & Chen, 2022). Furthermore, samples from different jurisdictions display varied levels of agreement and knowledge of health risks associated with cannabis use.

Attitudes toward Impaired Driving

What has been observed, but is not completely understood, is that cannabis users generally perceive a lower risk of CID leading to negative consequences (Goodman et al., 2020; Vaillancourt et al., 2021). Goodman and colleagues (2020) found that more frequent users of cannabis felt less at risk of being stopped or charged for CID by the police. Further, before

legalization, the Federal government reported that only 61% of cannabis users believed using cannabis impaired their driving (Goodman et al., 2020). Many young users also perceive CID as less risky and are more likely to engage in CID themselves, with one study finding high school students who reported part-year CID were about four times more likely than non-cannabis users to be involved in a motor vehicle accident (Asbridge et al., 2012).

Frequent cannabis use and low perceptions of the danger of CID are important risk factors for subsequent CID, RCID, and getting in a MVA (Goodman et al., 2020). As is true with cannabis use and many cannabis-related harm rates, males appear more likely to report supportive attitudes toward the idea of driving after using cannabis compared to females (Malholtra et al., 2017). These patterns suggest that impaired driving- and CID-related attitudes may influence the likelihood of engaging in CID, RCID, and other higher-risk cannabis use behaviours, meriting further investigation.

Ability to Recognize Impairment

Related to Canadian attitudes towards CID, is the ability of the public, especially cannabis users, to actively understand and recognize how cannabis impairment influences driving. The inability to recognize how cannabis impairs driving is a crucial barrier in the way of reducing cannabis-related risk for Canadians, especially among young people (Goodman et al., 2020). Prior to legalizing cannabis, national data found that around 16% of Canadians either believed that cannabis does not impair driving ability or were unsure (Wallingford et al., 2019). Further, only 24% of Canadians reported not knowing how long to wait after using cannabis to be able to drive safely (Wallingford et al., 2019). Young people report low recognition of CID dangerousness, with one study finding only 43% reported that they would try very hard to stop a

friend from engaging in CID, whereas 86% reported they would try very hard to stop a friend from engaging in alcohol-impaired driving (McDonald et al., 2021; Wallingford et al., 2019).

Differences in perceptions of AID and CID risk may suggest young people can be made aware of the riskiness of CID. Young adults appear to recognize the high danger of AID, showing that previous research and awareness campaigns may have worked to bring public knowledge of AID risk to an appropriate level; the same can be done with CID. Even cannabis users, who do not always recognize their level of cannabis impairment, report that alcohol strongly impairs their driving (McDonald et al., 2021; Terry & Wright, 2005). These variances may reflect differing social norms related to the dangerousness of CID compared to AID, in addition to the perceived legal risk of engaging in CID compared to AID (McDonald et al., 2021).

In general, Canadians perceive a higher likelihood of legal consequences of engaging in AID compared to CID (Goodman et al., 2020; McDonald et al., 2021; Terry & Wright, 2005). It is unclear whether this attitude is related to Canadians believing that law enforcement are more likely to charge an AID driver compared to a CID driver or that AID will lead them to drive poorly and be recognized as an impaired driver by law enforcement (McDonald et al., 2021). In general, there remains a lack of public education on the risks of CID and RCID, as well as related law enforcement-related procedures. More research is also required to fully understand the ability of Canadians to recognize the dangerousness of CID, RCID, and other cannabis-related harms. Knowing how well Canadians understand new laws, how much they trust law enforcement, and where they get their information on cannabis from, is crucial.

Attitudes toward Cannabis Legalization

Many Canadians support the idea of cannabis legalization, but it is less known if Canadians believe their government and law enforcement can successfully implement a well-functioning legalization plan (Lazor et al., 2022). Support for legalization and decriminalization of cannabis, as well as other substances, is constantly shifting and not fully understood, especially among Nova Scotians who may be less supportive of decriminalization policies, given higher cannabis use rates may indicate that legalization is more favoured (Rotermann, 2020). Male sex, single relationship status, high problematic drinking scores, low perceived risk of using substances, as well as high open-mindedness, low extraversion, and living outside of Atlantic Canada have been found to predict support for drug decriminalization (MacQuarrie & Brunelle, 2022).

Although neglected in the literature, attitudes related to cannabis legalization policy are important to know as legalized cannabis continues forward. Research considering attitudes such as support for and belief in governments and law enforcement to effectively create and enforce cannabis laws, are particularly sparse. Post-cannabis-legalization changes in support for the decriminalization or legalization of other substances is also understudied, despite the potential public health policy implications of increasing or decreasing support. Calls to close this gap have been made and researchers are starting to construct novel surveys covering less commonly addressed variables, specifically public health impacts and related attitudes (Lazor et al., 2022).

Sources of Knowledge and Awareness Campaigns

Throughout the process of cannabis legalization, the federal government, as well as many provincial and local governments, took numerous steps to create public health campaigns and other initiatives aimed to reduce potential public health harms for Canadians (MacKay et al.,

2017). Direct approaches included awareness campaigns aimed to provide evidence-based information about cannabis and cannabis legalization. Further efforts included local tightening of regulations on promotions, packaging, and advertising, in hopes of deterring marketers from targeting young, potential consumers.

Federal approaches for increasing awareness of cannabis-related risks were coordinated and rolled out in each province via national platforms, but differences in awareness efforts exist between provinces. For instance, Nova Scotia created online surveys on cannabis legalization for citizens to gain knowledge of legalization as well as voice their opinions. The effects of provincial surveys and awareness campaigns on public health outcomes have not been considered, despite large investments being made, by multiple levels of government, to improve public health.

Personality

Potentially more understudied than cannabis-related attitudes, is how personality influences higher-risk cannabis use. Personality traits, specifically Big 5 facets, are associated with different substance use outcomes, including cannabis-related ones (Pacheco & Humes, 2020). For example, high extraversion and low conscientiousness have been found to be associated with harmful drinking, while harmful cannabis use is associated with high openness-to-experience and low conscientiousness (Pacheco & Humes, 2020).

Personality has also been associated with low risk usage, defined as protective cannabis behaviours (Herchenroeder et al., 2022). Lower- risk cannabis use may be associated with higher conscientiousness, agreeableness, and lower emotional stability/higher neuroticism. Likelihood of engaging in lower risk behaviours is associated with both lower frequency of use and less cannabis-related consequences (Herchenroeder et al., 2022). However, there exist differences in

association directions and strength when comparing countries and jurisdictions, further exemplifying the need for more locally focused research. Personality affects not just the likelihood of higher-risk use behaviours, as other crucial health outcomes such as engaging in CID are also related to Big 5 facets (Pilin et al., 2022). Furthermore, early first use of cannabis, subsequent escalation of use, as well as problematic attitudes and cognitions towards cannabis among youth and young adults are important indicators of public health that have been found to be associated with personality (Pilin et al., 2022). These relationships are presently unclear and require further investigation to learn the nature of personality and legalized cannabis use.

Personality impacts how cannabis may differentially impair cannabis impaired drivers (Wickens et al., 2021). Using cannabis impairs driving differently than using alcohol, typically leading to reductions in mean speed as opposed to increases, with higher impulsivity being associated with greater reductions in speed while under the influence of cannabis (Wickens et al., 2021). Replication and novel research into differences in CID behaviours, as well as attitudes, and their relation to personality is required to better respond to impaired driving-related issues.

There is a growing amount of Canadian research on cannabis-related attitudes, at-risk groups, as well as subsequent higher-risk behaviours, related to cannabis use and impaired driving, in the context of federal legalization (Hall et al., 2023). However, the overall literature would benefit from much replication and further analyses, especially work focusing on how attitudes compare to well-studied group and individual risks (Cunningham, 2020; MacQuarrie & Brunelle, 2022). Further consideration of knowledge uptake opportunities for cannabis-involved stakeholders, with public health application, would also be of great value (Cloutier et al., 2022). The present thesis intends to capture valid data on underutilized attitudinal indicators combined with fundamental data on use behaviours and group characteristics. The thesis aims to provide a

pre- and post-legalization investigation to bolster current research efforts, as well as explore understudied and novel factors not typically captured in large-scale surveys of cannabis use or impaired driving behaviours (Lazor et al., 2022).

Current Study

The present thesis is a novel investigation into cannabis-related attitudes and higher-risk behaviours in Nova Scotia, over the course of legalization and Covid-19, as emerging evidence on impacts is mixed. Key cannabis-related behaviours (i.e., self-reported behaviours most relevant to cannabis legalization's intended impact on public health) are surveyed, in addition to overlooked attitudinal domains (Fischer et al., 2022; Lazor et al., 2022; MacKay et al., 2017). The study at-hand aims to contribute to a fuller understanding of cannabis-related attitudes and behaviours, by considering group and individual risks in sample of young adults. Analytic strategy is designed to allow for ease of future comparisons between Nova Scotia and other jurisdictions, as well as for replication. Overall, this research aspires to provide insight into how to best address public health impacts related to cannabis use and legalization, in a specialized and comprehensive way.

Research Goals

Principal research goals are to design a survey of cannabis legalization impacts; identify novel attitudes uniquely related to higher-risk cannabis use (while simultaneously replicating known relations among at-risk groups and behaviours); and determine if higher-risk use behaviours changed within Nova Scotia, over the course of cannabis legalization and Covid-19. A comprehensive survey design process precedes hypothesis testing, with the aim of creating a valid and reliable instrument to measure the impact of cannabis legalization, via relevant behaviours and attitudes. The resulting survey will be used to investigate four research questions,

each with a set of three hypotheses that aim to answer questions in adequate and accurate detail. Additional analyses will be conducted if further detail is required to meet a research goal or to interpret a hypothesis test result. Note that additional analyses are mainly exploratory and will have no bearing on hypothesis test decisions.

Survey Design

The Cannabis Legalization Impact Questionnaire (CLIQ) design was based on a comprehensive cannabis legalization literature review, proxy subject matter expert item generation process, exploratory factor analyses, reliability checks, and qualitative evaluation. Internal validity of the CLIQ was developed by adhering to evidence-based psychometric standards and was conducted prior to testing hypotheses. Data used in design processes were from the same set used for hypothesis testing (limitations of these data are considered, later on). CLIQ design procedures generally followed Hinkin's (1998) scale development process.

Item Generation. A review of pertinent literature guided the initial item generation process, followed by collaboration with one subject matter expert, and resulted in 99 total items. Originally, items were grouped, and domains were operationalized based on Fischer's Lower-Risk Cannabis Use Guidelines (LRCUG; 2011). Items covered attitudes and behaviours generally related to the domains of cannabis use, impaired driving, and cannabis legalization. Attitudinal items were in the form of statements that participants reported their agreement with, via a 9-point Likert-type scale. Self-report behavioural items were coded as binary, with follow up items considering frequency and recency of behaviours measured on 5- to 9-point Likert-type scales. All raw items and scales can be found in Appendices A, B, C, D, and E.

Domain Building. Prior to hypothesis testing, the LRCUG-based items and domains were established and modified to best fit the study's goals, intended sample population, and

quality of data available. Essential indicators of legalization impact (i.e., higher-risk cannabis use, impaired driving, and impaired riding), as well as relevant, underutilized domains (i.e., trust in abilities of law enforcement and attitudes towards retail regulations) were intended to be captured by the CLIQ (Fischer et al., 2011).

Factor Analyses. All 99 items went through an initial exploratory factor analysis (EFA), by which items were either grouped into an intended domain (e.g., cannabis use, impaired driving, etc.) or removed (if found to be unreliable or to not load appropriately within any relevant domain). Follow up EFAs then were conducted with the remaining items for each extracted domain, to determine if the fit indices and if the factor structural were viable. Principal Axis Factoring method of extraction and an oblique, ProMax rotation method were used to analyze and subsequently reorganize items into cannabis-relevant attitude and behaviour indexes, each with a single score representing a proposed domain.

The CLIQ was deemed ready for use in hypothesis testing when each index included one or more statistically valid and reliable factors that adequately represented the subject matter domains intended for capture (i.e., 4-7 items per factor, eigenvalues greater than or equal to 1, no multicollinearity, and appropriate results relating to communalities, factor loadings, Cronbach's alphas, and Bartlett's test of sphericity). For analyses, item groups were subsequently labelled as either an outcome or predictor index, with outcome indexes including behavioural risk items and predictor indexes comprising approved attitude items (indices are referred to as Behaviour and Attitude Indexes, when discussing results). See below for extracted factors and their subsequent index designations.

Outcome Indexes - Behaviours. Behaviour factor loadings (see Tables 2-4) are from the pattern matrixes. Eigenvalues ≥ 1 were used to interpret the number of factors in the survey.

Results showed that for the three behaviour indexes there were three factors on to which items were loading, explaining 56.68% of total variance.

Higher-Risk Cannabis Use (O1): The first outcome index contained 1 factor comprised of 5 items (items 1, 2, 4, 5, and 6), which appeared to measure potentially harmful cannabis consumption behaviours and was labelled Higher-Risk Cannabis Use (O1-HCU). A follow-up reliability analysis found the O1-HCU index to have good internal consistency ($\alpha = .810$).

Table 2

Outcome Index 1 (O1-HCU) - Result After the EFA Process (α = .810)

	Question	Domains	Loading	α
1	Cannabis use, how recently?	Cannabis	Factor 1/.830	.737
2	How often do you use cannabis?	Cannabis	Factor 1/.937	.713
3	How long have you been using cannabis, at this rate?	-	-	-
4	How much cannabis do you personally ingest during your average usage?	Cannabis	Factor 1/.479	.809
5	How often do you mix cannabis with tobacco?	Cannabis/Tobacco	Factor 1/.532	.805
6	How often do you mix cannabis with alcohol?	Cannabis/Alcohol	Factor 1/.660	.780
7	How much do you typically pay for cannabis?	-	-	-
8	How much cannabis do you typically purchase at one time?	-	-	-

Note: Principal Axis Factoring, Promax Rotation; Final KMO = .761; Bartlett's = <.001, x2 = 297.269.

Impaired-Driving (O2): The second outcome index contained 1 factor comprised of 7 items (items 9, 12, 13, 14, 15, 16, and 17), which appeared to measure potentially harmful impaired driving behaviours and was labelled Impaired Driving (O2-ID). A follow-up reliability analysis found the O2-ID index to have good internal consistency (α = .783).

Table 3

Outcome Index 2 (O2-ID) - Result After the EFA Process (α = .783)

	Question	Domains	Loading	α
9	How recently did you engage in CID?	ID/CID/Cannabis	Factor 1/.327	.769
10	How frequently do you engage in CID?	ID/CID/Cannabis	-	-
11	How soon after use did you engage in CID?	ID/CID/Cannabis	-	-
12	How recently did you engage in AID?	ID/AID/Alcohol	Factor 1/.464	.745
13	How frequently do you engage in AID?	ID/AID/Alcohol	Factor 1/.323	.776
14	How recently did you engage in DID?	ID/DID	Factor 1/.689	.763
15	How frequently do you engage in DID?	ID/DID	Factor 1/.637	.761
16	How recently did you engage in FID?	ID/FID	Factor 1/.768	.707
17	How frequently do you engage in FID?	ID/FID	Factor 1/.616	.757

Note: Principal Axis Factoring, Promax Rotation; Final KMO = .560; Bartlett's = <.001, x2=119.826. ID = Impaired Driving. CID = Cannabis-Impaired Driving. AID = Alcohol-Impaired Driving. DID = Distracted Driving. FID = Fatigued Driving.

Riding with an Impaired Driver (O3): The third outcome index contained 1 factor comprised of 7 items (items 18, 19, 20, 22, 23, 24, and 25), which appeared to measure potentially harmful riding with an impaired driver behaviours and was labelled Impaired Riding (O3-IR). A follow-up reliability analysis found the O3-IR index to have good internal consistency (α = .770).

Table 4

Outcome Index 3 (O3-IR) - Result After the EFA Process (α = .770)

	Question	Domains	Loading	α
18	Have you ever RCID?	CID/RID	Factor 1/.748	.747
19	Would you RCID?	CID/RID	Factor 1/.875	.747
20	Have you ever RAID?	RID/Alcohol	Factor 1/.383	.748
21	Would you RAID?	RID/Alcohol	-	-
22	Have you ever RDID?	RID/DID	Factor 1/.627	.737
23	Would you RDID?	RID/DID	Factor 1/.636	.756
24	Have you ever RFID?	RID/FID	Factor 1/.663	.727
25	Would you RFID?	RID/FID	Factor 1/.648	.725

Note: Principal Axis Factoring, Promax Rotation; Final KMO = .647; Bartlett's = <.001, x2 = 986.503. ID = Impaired Driving. CID = Cannabis-Impaired Driving. AID = Alcohol-Impaired Driving. DID = Distracted Driving. FID = Fatigued Driving.

Predictor Indexes – Attitudes. Attitude factor loadings (see Tables 5-12) are from the pattern matrixes. Eigenvalues ≥ 1 were used to interpret the number of factors in the data set. Results showed that there were thirteen factors on to which items were loading, explaining 69.04% of total variance.

General Cannabis Attitudes (P1A-B): The first predictor index contained 2 factors comprised of 4 items each (items 26, 31, 32, and 33; items 37, 40, 41, and 42). The first factor appeared to measure supportive attitudes towards support for consumer access and legalization and was labelled Cannabis Regulation (P1A-CR). The second factor appeared to measure supportive attitudes regarding the medicinal benefit of cannabis use and the comparatively lower

risk of cannabis use compared to other substances and was labelled Relative Cannabis Risk (P1B-RCR). A follow-up reliability analysis found the General Cannabis Attitudes index to have good internal consistency (α = .826). Both indexes were surveyed under the index of General Cannabis Attitudes then further analyzed individually, allowing for more sensitive interpretations via hypothesis testing (i.e., two distinct factors as opposed to one general factor, while still keeping in mind each factor was extracted from a single index, representing a common domain).

Table 5

Predictor Index 1 (P1A-CR; P1B-RCR) - Result After the EFA Process (α = .826)

	Question	Domains	Loading	α
26	Cannabis should be legal.	Legalization/Cannabis	Factor 1/.564	.799
27	The government should be responsible for the retail of cannabis.	Legalization/Cannabis	-	-
28	Private organizations should be responsible for the retail of cannabis.	Legalization/Cannabis	-	-
29	Cannabis is easy to obtain.	Cannabis	-	-
30	Cannabis will become easier to obtain once legalized.	Legalization/Cannabis	-	-
31	Canadians should be able to grow cannabis in their residence.	Legalization/Cannabis	Factor 1/.858	.788
32	Canadians should be able to grow cannabis outdoors on their property.	Legalization/Cannabis	Factor 1/.799	.803
33	Cannabis should be available for purchase online and have home delivery service.	Legalization/Cannabis	Factor 1/.623	.804
34	Legalization will help limit the illegal sale of cannabis.	Legalization/Cannabis	-	-
35	Legalization will make it easier for youth to access cannabis.	Legalization/Cannabis	-	-
36	Legalization will help make our roads safer from impaired drivers.	Legalization/CID/ID	-	-
37	Cannabis has medicinal benefits.	Cannabis	Factor 2/.413	.814
38	Cannabis can be addictive.	Cannabis	-	-
39	Using cannabis can be a risk to one's health.	Cannabis	-	-
40	Using cannabis is less risky to one's health than drinking alcohol.	Cannabis/Alcohol	Factor 2/.774	.806
41	Using cannabis is less risky to one's health than using tobacco.	Cannabis/Tobacco	Factor 2/.793	.811
42	Using cannabis is less risky to one's health than using other drugs.	Cannabis/Substance Use	Factor 2/.619	.818

Note: Principal Axis Factoring, Promax Rotation; Final KMO = .810; Bartlett's = <.001, x2=1339.317.

Cannabis Legalization Support (P2A-D): The second predictor index contained 4 factors comprised of 14 total items (items 43-56). The first factor, containing items 53-56, appeared to measure supportive attitudes towards government preparedness for cannabis legalization and was labelled Government Preparedness (P2A-GP). The second factor, containing items 43-46, appeared to measure supportive attitudes towards law enforcement preparedness for cannabis legalization and was labelled Law Enforcement Preparedness (P2B-LP). The third factor, containing items 49-52, appeared to measure supportive attitudes regarding law enforcement preparedness to enforce new laws related to cannabis-impaired driving and was labelled Law Enforcement Impaired Driving Preparedness (P2C-LIP). The fourth factor, containing items 47 and 48, appeared to measure supportive attitudes regarding law enforcement ability to recognize cannabis-impaired driving and was labelled Law Enforcement Impaired Driving Recognition (P2D-LIR). A follow-up reliability analysis found the Cannabis Legalization Support index to have good internal consistency (α = .934). Similar to the General Cannabis Attitude index, these four factors were surveyed under the larger index of Cannabis Legalization Attitudes then further analyzed individually as individual indexes, allowing for more sensitive interpretations via hypothesis testing. Additionally, despite only containing 2 items (instead of the standard 4-items per factor), the P2D-LIR will be included in further analysis due to the topical relevance and novelty of the items, with related results to be interpreted with extra caution.

Table 6

Predictor Index 2 (P2A-GP; P2B-LI; P2C-LIP; P2D-LIR) - Result After the EFA Process (α = .934)

	Question	Domains	Loading	α
43	The Halifax Regional Police are prepared for the legalization of cannabis.	LE/Legalization/Cannabis	Factor 2/.829	.927
44	The RCMP are prepared for the legalization of cannabis.	LE/Legalization/Cannabis	Factor 2/.829	.927
45	The Halifax Regional Police are doing a good job of preparing for the legalization of cannabis.	LE/Legalization/Cannabis	Factor 2/.803	.927
46	The RCMP are doing a good job of preparing for the legalization of cannabis.	LE/Legalization/Cannabis	Factor 2/.819	.927
47	The Halifax Regional Police are able to recognize if a driver is impaired from the use of cannabis.	LE/CID/Cannabis	Factor 4/.897	.931
48	The RCMP are able to recognize if a driver is impaired from the use of cannabis.	LE/CID/Cannabis	Factor 4/.893	.931
49	The Halifax Regional Police are ready to enforce new laws relating to drivers impaired from the use of cannabis.	LE/CID/Cannabis	Factor 3/.851	.929
50	The RCMP are ready to enforce new laws relating to drivers impaired from the use of cannabis.	LE/CID/Cannabis	Factor 3/.714	.929
51	The Halifax Regional Police understand the newly proposed legal limits of driving under the influence of cannabis.	LE/CID/Cannabis	Factor 3/.851	.930
52	The RCMP understand the newly proposed legal limits of driving under the influence of cannabis.	LE/CID/Cannabis	Factor 3/.856	.930
53	The Federal government is prepared for the legalization of cannabis.	LE/Legalization/Cannabis	Factor 1/.884	.931
54	The Federal government is doing a good job of preparing for the legalization of cannabis.	LE/Legalization/Cannabis	Factor 1/.864	.928
55	The Provincial government is prepared for the legalization of cannabis.	LE/Legalization/Cannabis	Factor 1/.884	.929
56	The Provincial government is doing a good job of preparing for the legalization of cannabis.	LE/Legalization/Cannabis	Factor 1/.872	.928

Note: Principal Axis Factoring, Promax Rotation; Final KMO = .833; Bartlett's = <.001, x2=6904.012. LE = Law Enforcement.

Drug Legalization Support (P3): The third predictor domain contained 1 factor comprised of 6 items (items 57, 59, 60, 61, 62, and 63), which appeared to measure supportive attitudes towards the legalization of drugs other than cannabis and was labelled Drug Legalization (P3-DL). A follow-up reliability analysis found the P3-DL factor to have good internal consistency (α = .960).

Table 7

Predictor Index 3 (P3-DL) - Result After the EFA Process (α = .960)

	Question	Domains	Loading	α
57	The Federal government should legalize recreational Cocaine use.	Legalization/Substance Use	Factor 1/.883	.954
58	The Federal government should legalize recreational Psychedelic Mushroom use.	Legalization/Substance Use	-	-
59	The Federal government should legalize recreational MDMA/Ecstasy use.	Legalization/Substance Use	Factor 1/.921	.949
60	The Federal government should legalize recreational LSD/Acid use.	Legalization/Substance Use	Factor 1/.877	.954
61	The Federal government should legalize recreational Ketamine use.	Legalization/Substance Use	Factor 1/.923	.950
62	The Federal government should legalize recreational Heroin use.	Legalization/Substance Use	Factor 1/.926	.950
63	The Federal government should legalize recreational DMT use.	Legalization/Substance Use	Factor 1/.854	.957

Note: Principal Axis Factoring, Promax Rotation; Final KMO = .893; Bartlett's = .001, x2 = 3120.041.

Cannabis Knowledge Sources (P4): The fourth predictor domain contained 1 factor comprised of 7 items (items 64, 65, 67, 69, 70, 71, and 72), which appeared to measure breadth of cannabis knowledge sources and was labelled Knowledge Sources (P4-KS). A follow-up reliability analysis found the P4-KS factor to have good internal consistency (α = .792).

Table 8

Predictor Index 4 (P4-KS) - Result After the EFA Process (α =.792)

	Question	Domains	Loading	α
64	I have learned about cannabis through formal education.	Cannabis/Knowledge	Factor 1/.451	.787
65	I have learned about cannabis through use on television and in movies.	Cannabis/Knowledge	Factor 1/.533	.779
66	I have learned about cannabis through people I know who have used it.	Cannabis/Knowledge	-	-
67	I have learned about cannabis from government awareness campaigns.	Cannabis/Knowledge	Factor 1/.551	.767
68	I have learned about cannabis from my own personal use.	Cannabis/Knowledge	-	-
69	I have learned about cannabis from reading scientific studies.	Cannabis/Knowledge	Factor 1/.574	.772
70	I have learned about cannabis from news articles on the internet.	Cannabis/Knowledge	Factor 1/.834	.735
71	I have learned about cannabis from news articles shared on social media.	Cannabis/Knowledge	Factor 1/.787	.734
72	I have learned about cannabis from other sources.	Cannabis/Knowledge	Factor 1/.522	.776

Note: Principal Axis Factoring, Promax Rotation; Final KMO = .784; Bartlett's = <.001, x2=884.228.

Problematic Personal Substance Use (P5A-B): The fifth predictor domain contained 2 factors comprised of 4 items each (items 73-80). The first factor appeared to measure attitudes regarding personal risk and stigma related to cannabis use and was labelled Problematic Cannabis Use (P5A-PCU). A follow-up reliability analysis found the Personal Problematic Substance Use index to have good internal consistency (α = .811). The second factor appeared to measure attitudes regarding personal risk and stigma related to alcohol use and was named Problematic Alcohol Use (P5B-PAU). Similar to P1A-CR and P1B-RCR, both factors were labelled under the index of Problematic Personal Substance Use and further analyzed individually, allowing for more sensitive interpretations via hypothesis testing (i.e., two distinct factors as opposed to one general factor, while still keeping in mind each factor was extracted from a single index, representing a common domain).

Table 9

Predictor Index 5 (P5A-PCU; P5B-PAU) - Result After the EFA Process (α = .811)

	Question	Domains	Loading	α
73	My cannabis use is problematic.	Cannabis/Problem Use	Factor 1/.557	.789
74	My alcohol use is problematic.	Alcohol/Problem Use	Factor 2/.596	.805
75	I am afraid to be stigmatized for my cannabis use.	Cannabis/Problem Use	Factor 1/.810	.777
76	I am afraid to be stigmatized for my alcohol use.	Alcohol/Problem Use	Factor 2/.844	.780
77	I am stigmatized for my cannabis use.	Cannabis/Problem Use	Factor 1/.731	.783
78	I am stigmatized for my alcohol use.	Alcohol/Problem Use	Factor 2/.677	.790
79	My cannabis use is a threat to my job prospects.	Cannabis/Problem Use	Factor 1/.573	.792
80	My alcohol use is a threat to my job prospects.	Alcohol/Problem Use	Factor 2/.507	.799

Note: Principal Axis Factoring, Promax Rotation; Final KMO = .702; Bartlett's = <.001, x2=1423.553.

Impaired Driving Attitudes (P6-8): The sixth predictor domain contained 1 factor comprised of 6 items (items 81, 82, 83, 85, 86, and 87), which appeared to measure perceived dangerousness of impaired driving, generally, and was labelled Impaired Driving Dangerousness (P6-ID). A follow-up reliability analysis found the P6-ID factor to have good internal consistency (α = .831).

Table 10

Predictor Index 6 (P6-ID) - Result After the EFA Process (α = .831)

	Question	Domains	Loading	α
81	Driving under the influence of cannabis is dangerous.	Cannabis/ID	Factor 1/.606	.795
82	Driving under the influence of cannabis impairs your ability to drive.	Cannabis/ID	Factor 1/.592	.799
83	Driving under the influence of alcohol is dangerous.	Alcohol/ID	Factor 1/.612	.819
84	Driving under the influence of cannabis is less dangerous than driving under the influence of alcohol.	Cannabis/Alcohol	-	-
85	Driving while fatigued is dangerous.	ID/FID	Factor 1/.689	.813
86	Driving while distracted is dangerous.	ID/DID	Factor 1/.894	.785
87	Texting and driving is dangerous.	ID/DID	Factor 1/.778	.804

Note: Principal Axis Factoring, Promax Rotation; Final KMO = .715; Bartlett's = .000, x2=1946.332. ID = Impaired Driving. DID = Distracted Driving. FID = Fatigued Driving.

The seventh predictor domain contained 1 factor comprised of 4 items (items 88-91), which appeared to measure perceived personal ability to drive impaired and was labelled Impaired Driving Personal Ability (P7-IP). A follow-up reliability analysis found the P7-IP factor to have good internal consistency (α = .847).

Table 11

Predictor Index 7 (P7-IP) - Result After the EFA Process (α = .847)

	Question	Domains	Loading	α
88	I am better at driving under the influence of cannabis than others.	ID/CID/Personal	Factor 1/.627	.843
89	I am better at driving under the influence of alcohol than others.	ID/AID/Personal	Factor 1/.698	.821
90	I am better at driving while distracted than others.	ID/DID/Personal	Factor 1/.900	.746
91	I am better at driving while fatigued than others.	ID/FID/Personal	Factor 1/.829	.771

Note: Principal Axis Factoring, Promax Rotation; Final KMO = .770; Bartlett's = <.001, x2=803.981. ID = Impaired Driving. CID = Cannabis-Impaired Driving. AID = Alcohol-Impaired Driving. DID = Distracted Driving. FID = Fatigued Driving.

The eighth predictor domain contained 1 factor comprised of 7 items (items 92, 93, 95, 96, 97, 98, and 99), which appeared to measure perceived impaired driving acceptability (in general and for certain people/others) and was labelled Impaired Driving Acceptability (P8-IA). A follow-up reliability analysis found the P8-IA factor to have good internal consistency (α = .643).

Table 12

Predictor Index 8 (P8-IA) - Result After the EFA Process (α = .643)

	Question	Domains	Loading	α
92	Is it acceptable to drive under the influence of cannabis?	ID/CID	Factor 1/.288	.622
93	Is it acceptable for some people to drive while under the influence of cannabis, but not others?	ID/CID/Others	Factor 1/.243	.582
94	Is it acceptable to drive under the influence of alcohol?	ID/AID	-	-
95	Is it acceptable for some people to drive while under the influence of alcohol, but not others?	ID/AID/Others	Factor 1/.260	.642
96	Is it acceptable to drive while distracted? (e.g., being on your phone)	ID/DID	Factor 1/.540	.610
97	Is it acceptable for some people to drive while distracted, but not others?	ID/DID/Others	Factor 1/.562	.604
98	Is it acceptable to drive while fatigued? (i.e., very tired)	ID/FID	Factor 1/.526	.601
99	Is it acceptable for some people to drive while fatigued, but not others?	ID/FID/Others	Factor 1/.594	.573

Note: Principal Axis Factoring, Promax Rotation; Final KMO = .569; Bartlett's = <.001, x2=655.772. ID = Impaired Driving. CID = Cannabis-Impaired Driving. AID = Alcohol-Impaired Driving. DID = Distracted Driving. FID = Fatigued Driving.

Operationalization of CLIQ Behaviour and Attitude Indexes. In sum, the 16 factors extracted, each containing 2-8 items that fit together and represented relevant domains, were labelled as indexes for use in hypothesis testing. Of the resulting 16 indexes, the 3 behaviour indexes were operationalized as dependent (outcome) variables and the 13 Attitude Indexes were defined as independent (predictor) variables. 20 items were deleted due to poor reliability or lack

of meaningful fit within any index. In addition, various potential domains (such as fatigued driving and distracted driving) did not have any meaningful or unique factors appear and were subsequently deleted or combined into other domains, with the remaining indexes deemed to best characterize the domains intended for measurement by the CLIQ. Further, given this is the first data collected with participants in the CLIQ development process, EFAs were largely exploratory. Ranges, means and standard deviations for each index score are presented in the method and results sections.

Hypotheses

Research Question 1. The first research question asks: are higher-risk cannabis use, impaired driving, or impaired riding outcomes more common in individuals who began using cannabis at a young age? Research question 1 will begin to consider if the CLIQ outcome indexes display convergent validity alongside one of the most well-established predictors of cannabis use outcomes (i.e., younger age of first cannabis use). Additional analyses considering prevalence of individual risks among users who began using cannabis at a young age, will be conducted where appropriate. Research question 1 will be investigated via three hypotheses (1.1-1.3).

Hypothesis 1.1: Users who first used cannabis at a younger age (before 18-years-old compared to after 18-years-old) will report higher scores on the Higher-Risk Cannabis Use Behaviour Index (O1-HCU).

Hypothesis 1.2: Users who first used cannabis at a younger age (before 18-years-old compared to after 18-years-old) will report higher scores on the Impaired Driving Behaviour Index (O2-ID).

Hypothesis 1.3: Users who first used cannabis at a younger age (before 18-years-old compared to after 18-years-old) will report higher scores on the Impaired Riding Behaviour Index (O3-IR).

Research Question 2. The second research question asks: are certain attitudes related to higher-risk cannabis use, impaired driving, or impaired riding behaviours? Specifically, if personal problematic cannabis use, personal impaired driving ability, and general impaired driving acceptability attitudes will be correlated with respective higher-risk cannabis use, impaired driving, and impaired riding behaviours. Additional analyses will be conducted to investigate associations between Attitude Indexes and Behaviour Indexes (as well as between all Attitude Index scores) to further consider convergent, discriminant, and construct validity of the indexes within the CLIQ. Research question 2 will be investigated via three hypothesis tests (2.1-2.3).

Hypothesis 2.1: Problematic Cannabis Use Attitude Index (P5A-PCU) scores will be positively associated with Higher-Risk Cannabis Use Behaviour Index (O1-HCU) scores.

Hypothesis 2.2: Impaired Driving Personal Ability Attitude Index (P7-IPA) scores will be positively associated with Impaired Driving Behaviour Index (O2-ID) scores.

Hypothesis 2.3: Impaired Driving Acceptability Index (P8-IA) scores will be positively associated with Impaired Riding Behaviours Index (O3-IR) scores.

Research Question 3. The third research question asks: do certain attitudes predict higher-risk cannabis use, impaired driving, or impaired riding behaviours? Specifically, if personal problematic cannabis use, personal impaired driving ability, and general impaired driving acceptability attitudes will be predictive of respective higher-risk cannabis use, impaired driving, and impaired riding behaviours. Research question 3 investigates predictive

relationships among attitudes and behaviours, extending upon correlational analyses in research question 2, to further identify most relevant variables related to cannabis harm. Additional analyses will investigate if attitudes predict engagement in individual cannabis risks, to further consider predictive and incremental validity of these indexes within the CLIQ. Research question 3 will be investigated via three hypothesis tests (3.1-3.3).

Hypothesis 3.1: Problematic Cannabis Use Attitude Index (P5A-PCU) scores will be uniquely predictive of Higher-Risk Cannabis Use Behaviour Index (O1-HCU) scores, when accounting for demographic predictors.

Hypothesis 3.2: Impaired-Driving Personal Ability Attitude Index (P7-IPA) scores will be uniquely predictive of Impaired Driving Behaviour Index (O2-ID) scores, when accounting for demographic predictors.

Hypothesis 3.3: Impaired-Driving Acceptability Index (P8-IA) scores will be uniquely predictive of Impaired Riding Behaviours Index (O3-IR) scores, when accounting for demographic predictors.

Research Question 4. The fourth research question asks: did higher-risk cannabis use, impaired driving, or impaired riding behaviours increase after cannabis legalization? Additional analyses will be conducted to determine if rates of any individual cannabis risk behaviours have changed since legalization. Research question 4 will be investigated via three hypothesis tests (4.1-4.3).

Hypothesis 4.1: Pre-legalization collection phase Higher-Risk Cannabis Use Behaviours Index (O1-HRU) scores will be lower than post-legalization collection phase scores.

Hypothesis 4.2: Pre-legalization collection phase Impaired Driving Behaviours Index (O2-ID) scores will be lower than post-legalization collection phase scores.

Hypothesis 4.3: Pre-legalization collection phase Impaired Riding Behaviours Index (O3-IR) scores will be lower than post-legalization collection phase scores.

Method

Participants

Participants comprised a sample of Saint Mary's University students who completed the survey for credit in a psychology course. Eligibility criteria included being at least 18 years old and currently being a registered student in Canada. Response sets were excluded if they had missing data or were deemed an ingenuine effort. Excluded participants, based on missing data, were response sets with less than 95% of questions completed. In addition, exclusions based on being deemed ingenuine were response sets with inconsistent or nonsensical answers throughout the survey. 608 participants were included in the final sample after data was cleaned. Data were collected over the course of three sampling periods. Phase 1, pre-legalization data were collected from June 2018 to October 2018. Phase 2, post-legalization/mid-Covid-19 data were collected from October 2018 to December 2020. Phase 3, post-legalization/post-Covid-19 data were collected from September 2022 to December 2022.

Procedure

Recruitment occurred through the Saint Mary's University online SONA system and data was collected through Qualtrics research software. Participants completed the survey via computer, cellphone, or tablet. All data provided by respondents were anonymous, and information was kept confidential. In all cases, respondents were provided with information about the study and asked to provide consent before participating. Students were reassured their anonymity after providing consent and proceeded to the survey. The research project was

approved by the Saint Mary's University Ethics Board. See Appendix F for consent and debriefing forms.

Power Analysis

A priori power analyses were completed via G*Power software (Faul et al., 2007) to determine the minimum number of participants required for the study. A goal of medium effect sizes was established (based on sizes displayed in related literature; Lazor et al., 2022), and strategically incorporated into analytic procedures. To achieve a medium effect size ($f = 0.25$, $\alpha = 0.05$, power = 0.8) for hypotheses 1 and 4 (both fixed effects, omnibus, one-way ANOVAs, involving three groups), 159 participants per group and 477 participants total are needed. To achieve a medium effect size ($q = 0.3$, $\alpha = 0.05$, power = 0.8) for hypothesis 2 (two independent Pearson *r*'s, correlations), 141 participants per group and 282 participants total are needed. To achieve a medium effect size ($f^2 = 0.15$, $\alpha = 0.05$, power = 0.8) for hypothesis 3 (fixed model, single regression coefficient, linear multiple regression), 352 participants total were needed. The final sample at-hand encompassed 608 respondents, which comprised 459 past-year cannabis users whose data were included in the main analysis – a size deemed appropriate enough to proceed with the main data analysis.

Measures

Behavioural, attitudinal, and group variables related to cannabis use and cannabis-impaired driving were measured in the Cannabis Legalization Impact Questionnaire (CLIQ) and by a standard assessment of relevant demographics. Attitudinal and behavioural variables were based on essential indicators of public health related to cannabis legalization within Canada. Items and variables were developed through consideration of evidence-based recommendations from the literature and federal government (Fischer et al., 2019; Fischer et al., 2022; Lazor et al.,

2022; MacKay et al., 2017). Specific domain selection, scoring, and operationalizations were built on best practices for cannabis survey creation, as well as psychometric and survey content gaps identified within the cannabis legalization research (Fischer et al., 2011; Hall & Lynskey, 2020; Hinkin, 1998; Lazor et al., 2022).

Demographics

Group and individual characteristics captured are personality (i.e., Big 5 Facets; Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism; O'Keefe et al., 2012), self-identified cannabis user status (i.e., recreational, medicinal, both recreational/medicinal, or neither), age of first time using cannabis, and sociodemographic variables (i.e., age, sex, ethnicity, education, personal income, and family income while growing up). See Appendix E for all raw demographic group and individual characteristic items.

Cannabis Legalization Impact Questionnaire

Respondent scores for each Cannabis Legalization Impact Questionnaire (CLIQ) index were created by summing the Likert-type scale response scores for each item within an index into a total index score, in order to create sensitive measures that retained as much variance as possible. Potential scoring ranges for each CLIQ index are presented below, while participant means and standard deviations are described in the results section. Item- and factor-wise details for each index are described in Tables 2-12, in the Survey Design section, and all raw items can be found in Appendices A-D.

Behaviour/Outcome Index Scoring - Higher-Risk Behaviours: Ranges for respondent scores on the three Behaviour Indexes were 1-25 for Higher-Risk Cannabis Use (O1-HCU), 1-35 for Impaired Driving (O2-ID), and 0-7 for Impaired Riding (O3-IR). Cannabis use behaviour

items are detailed in Appendix A and impaired driving behaviour items are detailed in Appendix B.

Attitude/Predictor Index Scoring - Cannabis-Related Attitudes: Ranges for respondent scores on the ten Cannabis-Related Attitude Indexes were 4-36 for Cannabis Regulation (P1A-CR), 4-36 for Relative Cannabis Risk (P1B-RCR), 4-36 for Government Preparedness (P2A-GP), 1-18 for Law Enforcement Preparedness (P2B-LP), 2-36 for Law Enforcement Impaired Driving Preparedness (P2C-LIP), 3-36 for Law Enforcement Impaired Driving Recognition (P2D-LIR), 1-54 for Drug Legalization (P3-DL), 7-63 for Knowledge Sources (P4-KS), 5-36 for Problematic Cannabis Use (P5A-PCU), and 7-36 for Problematic Alcohol Use (P5B-PAU) (note that P5A and P5B scores were inverted to represent healthy use during analyses (i.e., meaning scores appear negatively related to higher-risk, in results), but are discussed as non-inverted measures of problematic use during interpretations). Cannabis-related attitude items are detailed in Appendix C.

Impaired Driving Attitudes: Ranges for respondent scores on the three Impaired Driving Attitude Indexes were 6-54 for Impaired Driving Dangerousness (P6-ID), 1-36 for Impaired Driving Personal Ability (P7-IPA), and 0-6 for Impaired Driving Acceptability (P8-IA). Impaired driving attitude items are detailed in Appendix D.

Individual Cannabis Use Risk Variables.

For additional analyses, unrelated to hypothesis testing, eight individual cannabis use risk variables were collected. These included: daily or almost daily use (DAD), smoking as primary mode of consumption, mixing cannabis with tobacco, mixing cannabis with alcohol, never using CBD-dominant cannabis, never being aware of THC content for cannabis used, riding as passenger with a cannabis-impaired driver (RCID), and engaging in cannabis-impaired driving

(CID). Each individual risk was coded as a binary variable (and treated as outcome variables in logistic regressions), with respondents either reporting that they have engaged (yes = 2) or not engaged (no = 1) in a specified cannabis use risk, ever in their life.

Data Analysis

Calculations were performed using SPSS Statistics software. All necessary assumption checks were tested, met, and are discussed where appropriate. Frequencies and descriptive statistics were used to display sample characteristics and confirm sample appropriateness. Hypotheses 1 and 4 were tested via significant differences between index scores among groups of interest and collection phase samples of interest, comprising appropriate statistical comparisons (via t-test or analysis of variance (ANOVA) for continuous variables and $\chi 2$ for categorical variables, including Bonferroni post-hoc analyses where appropriate). For hypothesis 2, Pearson's *R* correlations among variables were calculated to investigate proposed significant relationships and potentially inform regression model building. To build upon correlational analyses in hypothesis 2, hypothesis 3 discerned what predicts cannabis-related outcomes by entering all variables of theoretical importance into hierarchical regression models with behaviour indexes (and individual risk behaviours, for additional analyses) as the dependent variables (multiple linear regression for continuous outcome index scores; binary logistic regression for dichotomous individual outcomes, for additional analyses).

Results

Sample Characteristics

Participant Flow and Collection Dates

Of the full, 608-person sample, past-year cannabis use was reported by 459 (75.5%) participants, whose responses relating to attitudes and behaviours were subsequently included in

the main analysis (see Tables 13 and 14 for descriptive details of both the full and user samples). Data were collected over the course of three collection periods, deemed Phase I (*N* = 130; 28.3%), Phase II (*N* = 176; 38.3%), and Phase III (*N* = 153; 33.3%).

Group Memberships and Descriptives

Group membership details, for all participants, are presented in Tables 13 and 14. The past-year user sample (i.e., users) consisted of 103 (22.4%) males and 356 (77.6%) females. Ethnic origins of users included European (*N* = 355; 78.1%), Asian (*N* = 48; 10.0%), African (*N* = 32; 6.8%), and American (*N* = 11; 2.5%). Users were 21.77 years-old (*SD* = 4.69), on average. Mean personal income was $40,000-$49,000 (*SD* = $5,500) and mean family income growing up was $60,000-$69,000 (*SD* = $5,500), annually. Highest education level achieved by users included high school (*N* = 373; 80.2%), college (*N* = 37; 8.1%), and university (bachelor or master's degrees) (*N* = 49; 10.7%). Average user Big Five Personality scores were 16.45 (*SD* = 5.75) for Openness to Experience, 20.26 (*SD* = 5.36) for Conscientiousness, 16.58 (*SD* = 5.88) for Extraversion, 22.94 (*SD* = 3.95) for Agreeableness, and 18.43 (*SD* = 5.65) for Neuroticism.

Self-identified status of personal cannabis use included recreational-only users (*N* = 286; 62.3%), medicinal-only users (*N* = 25; 5.4%), dual recreational and medicinal users (*N* = 48; 10.5%), as well as users who identified as neither recreational nor medical users (i.e., "neither" users; *N* = 99; 21.6%). Average age of first cannabis use was 16.81 years-old (*SD* = 2.80).

Table 13

Sample Characteristics

Demographic Group	Past-Year User Sample				Full Sample (*N* = 608) *N* (%)
	Phase I (*N* = 130) *N* (%)	Phase II (*N* = 176) *N* (%)	Phase III (*N* = 153) *N* (%)	Total (*N* = 459) *N* (%)	
Gender					
Male	32 (24.4%)	32 (18.6%)	39 (25.3%)	103 (22.4%)	137 (22.7%)
Female	99 (75.6%)	144 (81.4%)	114 (72.7%)	356 (77.6%)	466 (77.3%)
Age					
17-20	67 (52.5%)	94 (54.9%)	79 (53.4%)	240 (53.7%)	340 (57.8%)
21-24	34 (27.9%)	52 (29.6%)	49 (31.8%)	135 (29.9%)	166 (28.2%)
25-28	10 (8.2%)	12 (7.4%)	11 (7.4%)	33 (7.6%)	36 (6.1%)
29+	14 (11.5%)	13 (8.0%)	12 (7.4%)	39 (8.8%)	46 (7.8%)
M(SD)	22.07 (5.18)	21.57 (4.25)	21.79 (4.71)	21.77 (4.69)	21.51 (4.75)
Ethnicity					
African	12 (9.4%)	9 (4.8%)	11 (6.7%)	32 (6.8%)	51 (8.7%)
American	8 (6.3%)	1 (0.6%)	2 (1.3%)	11 (2.5%)	11 (1.9%)
Asian	10 (7.8%)	23 (12.0%)	15 (9.4%)	48 (10.0%)	79 (13.6%)
European	99 (75.6%)	138 (79.6%)	118 (78.5%)	355 (78.1%)	442 (75.8%)

Table 14

Sample Characteristics, continued

Demographic & User Group	Past-Year User Sample				Full Sample (N = 608) N (%)
	Phase I (N = 130) N (%)	Phase II (N = 176) N (%)	Phase III (N = 153) N (%)	Total (N = 459) N (%)	
Personality					
Openness	17.49 (5.58)	16.29 (5.89)	15.75 (5.65)	16.45 (5.75)	16.12 (5.73)
Consc.	20.34 (4.79)	21.15 (5.12)	19.19 (5.90)	20.26 (5.36)	20.53 (5.36)
Extraversion	16.12 (6.07)	16.62 (5.96)	16.93 (5.63)	16.58 (5.88)	16.24 (5.88)
Agreeableness	22.57 (4.87)	23.27 (3.66)	22.90 (3.66)	22.94 (3.95)	22.83 (4.03)
Neuroticism	17.72 (5.72)	19.12 (5.52)	18.27 (5.67)	18.43 (5.65)	18.33 (5.83)
Use Status					
Neither	31 (24.4%)	35 (18.0%)	33 (21.3%)	99 (21.6%)	-
Med Only	15 (10.2%)	9 (3.6%)	1 (0.0%)	25 (5.4%)	-
Med/Rec	16 (12.6%)	24 (14.4%)	8 (5.3%)	48 (10.5%)	-
Rec Only	67 (52.8%)	108 (64.1%)	111 (73.3%)	286 (62.3%)	-
Age of 1st Use					
9-15	49 (37.0%)	45 (24.6%)	41 (27.3%)	135 (29.1%)	-
16-17	46 (35.4%)	54 (31.1%)	42 (27.3%)	142 (31.1%)	-
18+	28 (20.5%)	64 (37.1%)	63 (41.3%)	155 (33.8%)	-
M(SD)	16.08 (2.19)	17.16 (3.01)	17.08 (2.90)	16.81 (2.80)	-

Note: Consc. = Conscientiousness.

Behaviour and Attitude Indexes

Higher-Risk Behaviours: Mean user scores on the three Behaviour Indexes were 9.56 (*SD* = 5.25) for Higher-Risk Cannabis Use (O1-HCU), 10.60 (*SD* = 5.90) for Impaired Driving (O2-ID), and 2.78 (*SD* = 2.17) for Impaired Riding (O3-IR). See Table 16 for Behaviour Index scores among demographic groups.

Cannabis-Related Attitudes: Mean user scores on the ten cannabis-related Attitude Indexes were 25.86 (*SD* = 8.81) for Cannabis Regulation (P1A-CR), 26.62 (*SD* = 6.35) for Relative Cannabis Risk (P1B-RCR), 19.99 (*SD* = 8.08) for Government Preparedness (P2A-GP), 9.23 (*SD* = 4.68) for Law Enforcement Preparedness (P2B-LP), 22.11 (*SD* = 8.31) for Law Enforcement Cannabis-Impaired Driving Preparedness (P2C-LIP), 22.14 (*SD* = 8.59) for Law Enforcement Cannabis-Impaired Driving Recognition (P2D-LIR), 14.29 (*SD* = 12.80) for Drug Legalization (P3-DL), 32.12 (*SD* = 12.59) for Knowledge Sources (P4-KS), 31.07 (*SD* = 6.78) for Problematic Cannabis Use (P5A-PCU), and 32.30 (*SD* = 5.43) for Problematic Alcohol Use (P5B-PAU). See Tables 15 and 16 for cannabis-related Attitude Index scores among demographic groups.

Impaired Driving Attitudes: Mean user scores on the three impaired driving Attitude Indexes were 47.08 (*SD* = 7.74) for Impaired Driving Dangerousness (P6-ID), 9.56 (*SD* = 7.48) for Impaired Driving Personal Ability (P7-IP), and 0.95 (*SD* = 1.32) for Impaired Driving Acceptability (P8-IA). See Tables 15 and 16 for impaired driving Attitude Index scores among demographic groups.

Table 15

Mean Index Scores for Demographic Groups

	Attitudes							
Group	P1A-CR *M (SD)*	P1B-RCR *M (SD)*	P2A-GP *M (SD)*	P2B-LP *M (SD)*	P2C-LIP *M (SD)*	P2D-LIR *M (SD)*	P3-DL *M (SD)*	P4-KS *M (SD)*
Gender								
Female	25.74 (9.00)	28.84 (6.17)	19.75 (8.19)	9.08 (4.58)	22.09 (8.23)	21.99 (8.73)	13.83 (12.67)	32.35 (12.70)
Male	26.28 (8.12)	27,86 (6.89)	20.82 (7.67)	9.75 (5.02)	22.18 (8.62)	22.64 (8.11)	15.83 (13.13)	31.67 (12.26)
Stats	*t*(457)=0.545; *d*=-.061, *p*=.293	*t*(453)=-1.375; *d*=.154, *p*=.085	*t*(446)=1.185; *d*=.133, *p*=.118	*t*(444)=1.264; *d*=-.144, *p*=.103	*t*(441)=0.094; *d*=.011, *p*=.463	*t*(452)=0.668; *d*=-.075, *p*=.252	*t*(451)=1.420; *d*=-.159, *p*=.078	*t*(453)=-0.409; *d*=.046, *p*=.341
Age								
17-20	25.15 (9.24)	28.73 (6.31)	20.48 (8.23)	9.80 (4.78)	22.87 (8.46)	22.13 (8.44)	12.83 (11.40)	32.41 (12.22)
21-24	26.47 (7.83)	28.79 (6.03)	20.19 (7.65)	8.97 (4.48)	21.33 (7.59)	23.10 (8.29)	15.11 (13.71)	34.43 (12.81)
25-28	25.97 (8.94)	29.67 (6.49)	18.70 (7.83)	8.70 (4.32)	21.82 (8.65)	22.45 (8.20)	17.78 (13.04)	26.15 (11.19)
29+	27.56 (9.30)	26.33 (7.73)	17.82 (7.77)	6.62 (4.21)	20.58 (8.78)	17.64 (9.22)	19.32 (16.77)	28.39 (13.36)
Stats	*F*(3;446)=1.215; ω2=.001, *p*=.304	*F*(3;442)=2.024; ω2=.007, *p*=.110	*F*(3;435)=1.543; ω2=.004, *p*=.203	*F*(3;433)=5.388; ω2=.029, *p*=.001**	*F*(3;430)=1.468; ω2=.003, *p*=.223	*F*(3;441)=4.272; ω2=.022, *p*=.005*	*F*(3;440)=3.938; ω2=.020, *p*=.009**	*F*(3;442)=5.254; ω2=.028, *p*=.001**
Ethnicity								
African	21.59 (9.66)	26.97 (8.60)	18.10 (7.04)	10.48 (4.35)	24.42 (6.85)	23.00 (8.33)	12.80 (14.20)	31.28 (12.38)
American	25.82 (9.08)	28.27 (5.80)	14.09 (6.43)	7.82 (3.19)	18.91 (9.40)	16.36 (7.62)	12.55 (12.52)	32.09 (15.05)
Asian	21.44 (10.08)	27.92 (6.88)	21.66 (9.65)	9.81 (5.02)	22.43 (9.10)	22.89 (9.82)	16.72 (15.19)	33.81 (12.28)
European	26.99 (8.18)	28.91 (6.03)	20.15 (7.92)	9.06 (4.71)	22.03 (8.37)	22.14 (8.50)	14.12 (12.45)	31.98 (12.67)
Stats	*F*(3;445)=9.029; ω2=.051, *p*<.001***	*F*(3;438)=1.162; ω2=.001, *p*=.324	*F*(3;433)=3.251; ω2=.015, *p*=.022*	*F*(3;434)=1.357; ω2=.002, *p*=.256	*F*(3;431)=1.223; ω2=.002, *p*=.301	*F*(3;440)=1.866; ω2=.006, *p*=.135	*F*(3;439)=0.780; ω2=.000, *p*=.506	*F*(3;441)=0.346; ω2=.000, *p*=.792

Note. $N = 459$. * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 16

Mean Index Scores for Demographic Groups, continued

	Attitudes					Behaviours		
Group	P5A-PCU *M (SD)*	P5B-PAU *M (SD)*	P6-ID *M (SD)*	P7-IPA *M (SD)*	P8-IA *M (SD)*	O1-HCU *M (SD)*	O2-ID *M (SD)*	O3-IR *M (SD)*
Gender								
Female	31.47 (6.54)	32.58 (5.11)	47.07 (8.04)	9.21 (7.47)	0.92 (1.28)	9.63 (5.16)	10.64 (5.68)	2.76 (2.14)
Male	29.71 (7.42)	31.32 (6.33)	47.08 (6.62)	10.75 (7.45)	1.08 (1.43)	9.34 (5.58)	10.45 (6.56)	2.83 (2.28)
Stats	*t*(452)=2.329; *d*=.261, *p*=.016*	*t*(454)=2.081; *d*=.233, *p*=.033*	*t*(457)=0.017; *d*=.002, *p*=.493	*t*(439)=1.813; *d*=.206, *p*=.035*	*t*(454)=1.084; *d*=.122, *p*=.139	*t*(445)=0.478; *d*=.054, *p*=.648	*t*(337)=0.266; *d*=.034, *p*=.805	*t*(456)=0.254; *d*=.028, *p*=.806
Age								
17-20	31.01 (6.38)	32.26 (5.13)	47.60 (7.86)	9.34 (7.35)	0.92 (1.33)	10.04 (5.28)	10.51 (6.13)	2.65 (2.19)
21-24	30.82 (7.75)	32.13 (6.05)	46.14 (7.89)	9.95 (7.81)	1.08 (1.39)	9.22 (4.86)	10.82 (5.66)	2.76 (2.19)
25-28	32.06 (5.43)	33.55 (4.42)	46.30 (7.13)	8.81 (5.93)	0.88 (1.05)	8.97 (5.79)	8.77 (4.30	3.00 (1.75)
29+	32.34 (6.62)	32.94 (4.83)	47.56 (6.83)	9.89 (7.42)	0.90 (1.23)	8.16 (5.50)	12.69 (6.09)	3.72 (2.27)
Stats	*F*(3;441)=0.728; ω2=.000, *p*=.535	*F*(3;444)=0.801; ω2=.000, *p*=.494	*F*(3;446)=1.186; ω2=.001, *p*=.315	*F*(3;429)=.316; ω2=.000, *p*=.814	*F*(3;443)=0.521; ω2=.000, *p*=.668	*F*(3;434)=1.904; ω2=.006, *p*=.128	*F*(3;334)=2.115; ω2=.010, *p*=.098	*F*(3;445)=2.787; ω2=.012, *p*=.040*
Ethnicity								
African	30.97 (6.76)	30.57 (8.10)	45.97 (8.93)	12.17 (8.11)	0.74 (1.39)	8.45 (4.93)	9.63 (5.19)	2.22 (2.19)
American	32.18 (6.13)	31.64 (3.80)	41.18 (14.63)	10.36 (8.37)	0.55 (0.82)	7.91 (5.34)	10.56 (6.93)	3.27 (2.68)
Asian	28.42 (8.60)	31.04 (6.73)	46.10 (9.21)	11.00 (8.99)	0.87 (1.29)	10.37 (5.65)	8.78 (7.83)	1.74 (2.02)
European	31.35 (6.48)	32.54 (5.03)	47.48 (7.01)	9.14 (7.19)	0.97 (1.30)	9.68 (5.19)	10.73 (5.68)	2.92 (2.15)
Stats	*F*(3;440)=2.770; ω2=.012, *p*=.041*	*F*(3;442)=2.091; ω2=.014, *p*=.101	*F*(3;445)=2.975; ω2=.013, *p*=.031*	*F*(3;428)=2.128; ω2=.008, *p*=.096	*F*(3;442)=0.707; ω2=.000, *p*=.548	*F*(3;433)=1.211; ω2=.001, *p*=.305	*F*(3;330)=0.935; ω2=.000, *p*=.424	*F*(3;444)=5.064; ω2=.027, *p*=.002**

Note. $N = 459$. * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Evaluation of Hypotheses

Research Question 1 – Age of 1st Cannabis Use and Behaviour Indexes

The first research question was: are higher-risk cannabis use, impaired driving, or impaired riding outcomes more common in individuals who began using cannabis at a young age? Hypotheses specifically predicted users who began cannabis use before age 18 will have higher higher-risk cannabis use (O1-HRU), impaired driving (O2-ID), and impaired riding (O3-IR) Behaviour Index scores, compared to those who began cannabis use after the age of 18.

Differences in Behaviour Index scores among age of 1st cannabis use groups were assessed via ANOVAs. Significantly higher scoring groups were identified via Bonferroni post-hoc analysis. Testing found that all three hypotheses, relating to research question 1, were supported. Results suggest certain groups report elevated rates of all three Behaviour Index scores. Table 18 presents *t, d, M, SD, F, df,* ω2, and *p*-value for the three Behaviour Index scores and user groups.

Hypothesis 1.1 – Age of 1st Cannabis Use and Higher-Risk Cannabis Use Index Scores.

It was predicted users who began cannabis use before age 18 will have higher O1-HRU Index scores, relative to those who began cannabis use after the age of 18. An ANOVA comparing those who first used before age 15, between ages 16-17, and at age 18 or above, found a significant difference in O1-HRU Index scores among these three groups ($p < .001$). Bonferroni post-hoc results indicated that respondents who first used cannabis at age 15 or younger reported significantly higher O1-HRU Index scores compared to those who first used at age 18 or older ($p < .001$). Hypothesis 1.1 was supported, as the critical test value was significant and matched the predicted directionality.

Hypothesis 1.2 - Age of 1st Cannabis Use and Impaired Driving Index Scores.

It was predicted users who began cannabis use before age 18 will have higher O2-ID Index scores, compared to those who began cannabis use after the age of 18. An ANOVA comparing those who first used before age 15, between ages 16-17, and at age 18 or above, found a significant difference in O2-ID Index scores among these three groups ($p < .001$). Bonferroni post-hoc results indicated that respondents who first used cannabis at age 15 or younger reported significantly higher O2-ID Index scores compared to those who first used at age 18 or older ($p = .001$). Further, Bonferroni post-hoc results indicated that respondents who first used cannabis between ages 16-17 reported significantly higher O2-ID Index scores compared to those who first used at age 18 or older ($p = .009$). Hypothesis 1.2 was supported, as the critical test value was significant.

Hypothesis 1.3 - Age of 1st Cannabis Use and Impaired Riding Index Scores.

It was predicted users who began cannabis use before age 18 will have higher O3-IR Index scores, compared to those who began cannabis use after the age of 18. An ANOVA comparing those who first used before age 15, between ages 16-17, and at age 18 or above, found a significant difference in O3-IR Index scores among these three groups ($p < .001$). Bonferroni post-hoc results indicated that respondents who first used cannabis at age 15 or younger reported significantly higher O3-IR Index scores, compared to those who first used at age 18 or older ($p < .001$) and between ages 16-17 ($p < .001$). In addition, Bonferroni post-hoc results indicated that respondents who first used between ages 16-17 reported significantly higher O3-IR Index scores compared to at age 18 or older ($p = .002$). Hypothesis 1.3 was supported, as the critical test value was significant.

Table 17

Mean Index Scores for User Groups

	Attitudes							
Group	P1A-CR *M (SD)*	P1B-RCR *M (SD)*	P2A-GP *M (SD)*	P2B-LP *M (SD)*	P2C-LIP *M (SD)*	P2D-LIR *M (SD)*	P3-DL *M (SD)*	P4-KS *M (SD)*
Age1st								
9-15	28.07 (8.20)	29.60 (6.47)	19.61 (7.61	8.59 (4.71)	21.85 (8.25)	21.76 (13.92)	15.95 (13.92)	31.48 (13.10)
16-17	29.96 (8.32)	28.87 (5.99)	18.87 (8.18)	8.73 (4.38)	20.76 (8.19)	21.11 (11.89)	12.35 (11.89)	31.71 (11.44)
18+	24.36 (8.58)	28.06 (6.38)	21.96 (7.91)	10.61 (4.59)	24.18 (7.68)	24.14 (13.03)	15.54 (13.03)	33.16 (13.25)
Stats	$F(2;431)=7.583$; $\omega^2=.030$, $p<.001$***	$F(2;428)=2.179$; $\omega^2=.005$, $p=.114$	$F(2;423)=6.057$; $\omega^2=.023$, $p=.003$**	$F(2;420)=8.825$; $\omega^2=.036$, $p<.001$***	$F(2;418)=6.804$; $\omega^2=.027$, $p=.001$**	$F(2;427)=5.369$; $\omega^2=.020$, $p=.005$**	$F(2;426)=3.241$; $\omega^2=.010$, $p=.040$*	$F(2;428)=0.769$; $\omega^2=.000$, $p=.464$
UseStat								
Neither	21.60 (9.27)	26.68 (6.59)	19.16 (8.53)	9.23 (4.94)	22.85 (8.65)	20.57 (9.43)	13.40 (13.20)	32.38 (13.91)
Rec	27.13 (8.27)	28.81 (6.18)	20.55 (7.64)	9.37 (4.52)	22.21 (7.96)	22.81 (8.08)	15.08 (13.10)	32.12 (12.15)
Med	22.44 (9.60)	27.04 (7.71)	17.76 (10.73)	8.92 (5.82)	21.40 (9.79)	19.08 (10.17)	12.00 (11.37)	35.48 (12.00)
Both	29.08 (6.90)	32.10 (4.10)	19.56 (8.11)	8.47 (4.58)	20.55 (8.91)	22.98 (8.47)	12.65 (10.84)	29.90 (12.79)
Stats	$F(3;457)=14.276$; $\omega^2=.080$, $p<.001$***	$F(3;453)=8.916$; $\omega^2=.050$, $p<.001$***	$F(3;446)=1.455$; $\omega^2=.003$, $p=.226$	$F(3;444)=0.534$; $\omega^2=.000$, $p=.659$	$F(3;441)=0.868$; $\omega^2=.000$, $p=.458$	$F(3;452)=2.903$; $\omega^2=.012$, $p=.035$*	$F(3;451)=1.048$; $\omega^2=.000$, $p=.371$	$F(3;453)=1.105$; $\omega^2=.001$, $p=.347$
Phase								
2018	24.43 (9.19)	29.12 (6.72)	18.60 (7.81)	8.77 (4.70)	21.63 (8.27)	19.55 (8.49)	11.65 (10.33)	31.71 (11.85)
2019-20	26.06 (8.89)	28.60 (6.06)	20.56 (8.45)	8.97 (4.63)	22.86 (8.63)	22.52 (8.76)	14.30 (12.85)	32.21 (12.80)
2022	26.86 (8.26)	28.20 (6.35)	20.56 (7.76)	9.95 (4.68)	21.63 (7.94)	23.97 (7.96)	16.58 (14.25)	32.36 (13.04)
Stats	$F(2;458)=2.770$; $\omega^2=.008$, $p=.064$	$F(2;454)=0.749$; $\omega^2=.000$, $p=.473$	$F(2;447)=2.736$; $\omega^2=.008$, $p=.066$	$F(2;445)=2.586$; $\omega^2=.007$, $p=.076$	$F(2;442)=1.152$; $\omega^2=.001$, $p=.317$	$F(2;453)=9.777$; $\omega^2=.037$, $p<.001$***	$F(2;452)=5.261$; $\omega^2=.019$, $p=.006$**	$F(2;454)=0.101$; $\omega^2=.000$, $p=.904$

Note. $N = 459$. Age 1st = age of first-time using cannabis. Use Stat = self-identified cannabis use status. Phase = collection phase. * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 18

Mean Index Scores for User Groups, continued

	Attitudes					Behaviours		
Group	P5A-PCU *M (SD)*	P5B-PAU *M (SD)*	P6-ID *M (SD)*	P7-IPA *M (SD)*	P8-IA *M (SD)*	O1-HCU *M (SD)*	O2-ID *M (SD)*	O3-IR *M (SD)*
Age1st								
9-15	30.46 (6.88)	32.38 (4.88)	45.53 (7.98)	10.81 (7.59)	1.42 (1.52)	10.93 (5.50)	11.75 (5.95)	3.85 (2.23)
16-17	30.79 (6.60)	32.01 (5.73)	46.92 (7.24)	9.53 (7.15)	0.94 (1.26)	9.93 (5.09)	11.25 (5.60)	2.87 (2.02)
18+	31.32 (7.09)	32.26 (5.79)	48.28 (8.14)	9.00 (7.63)	0.71 (1.13)	8.51 (4.79)	8.90 (4.79)	2.05 (1.88)
Stats	*t*(*F*(2;429)=0.582 ; $_{\omega}$2=.000, *p*=.559	*F*(2;428)=0.111; $_{\omega}$2=.000, *p*=.895	*F*(2;428)=4.511; $_{\omega}$2=.016, *p*=.012*	*F*(2;428)=2.134; $_{\omega}$2=.005, *p*=.120	*F*(2;428)=11.089; $_{\omega}$2=.045, *p*<.001***	*F*(2;431)=8.250; $_{\omega}$2=.032, *p*<.001***	*F*(2;327)=7.369; $_{\omega}$2=.037, *p*<.001***	*F*(2;430)=28.081 ; $_{\omega}$2=.112, *p*<.001***
UseStat								
Neither	34.01 (5.08)	33.52 (4.22)	49.05 (7.32)	8.55 (8.38)	0.60 (1.01)	4.57 (3.08)	8.94 (5.02)	2.56 (2.05)
Rec	30.42 (6.96)	32.03 (5.62)	46.25 (8.01)	9.94 (7.39)	1.05 (1.37)	10.84 (4.87)	11.35 (5.97)	2.86 (2.20)
Med	32.46 (7.50)	31.80 (7.05)	50.20 (5.76)	6.60 (4.79)	0.52 (0.96)	7.15 (4.80)	6.63 (4.41)	1.20 (1.71)
Both	28.48 (6.49)	31.77 (5.30)	46.48 (6.84)	10.67 (6.65)	1.33 (1.52)	12.63 (4.26)	11.03 (6.54)	3.46 (2.03)
Stats	*F*(3;452)=10.123 ; $_{\omega}$2=.057, *p*<.001***	*F*(3;454)=2.128; $_{\omega}$2=.007, *p*=.096	*F*(3;467)=4.806; $_{\omega}$2=.024, *p*=.003**	*F*(3;439)=2.211; $_{\omega}$2=.008, *p*=.086	*F*(3;454)=5.127; $_{\omega}$2=.027, *p*=.002**	*F*(3;445)=55.885; $_{\omega}$2=.270, *p*<.001***	*F*(3;337)=5.695; $_{\omega}$2=.040, *p*<.001***	*F*(3;456)=6.711; $_{\omega}$2=.036, *p*<.001***
Phase								
2018	31.98 (5.73)	32.41 (5.52)	45.81 (9.15)	9.94 (7.71)	0.94 (1.39)	9.24 (5.35)	9.81 (6.23)	2.65 (2.15)
2019-20	30.75 (7.08)	32.35 (5.53)	46.88 (6.83)	10.23 (8.09)	1.00 (1.26)	9.77 (5.69)	10.81 (5.87)	2.68 (2.13)
2022	30.67 (7.21)	32.14 (5.27)	48.39 (7.25)	8.47 (6.43)	0.92 (1.32)	9.60 (4.64)	11.02 (5.64)	3.00 (2.24)
Stats	*F*(2;453)=1.600; $_{\omega}$2=.003, *p*=.203	*F*(2;455)=0.101; $_{\omega}$2=.000, *p*=.904	*F*(2;458)=4.046; $_{\omega}$2=.013, *p*=.018*	*F*(2;440)=2.419; $_{\omega}$2=.006, *p*=.090	*F*(2;455)=0.182; $_{\omega}$2=.000, *p*=.833	*F*(2;446)=0.376; $_{\omega}$2=.000, *p*=.687	*F*(2;338)=1.301; $_{\omega}$2=.002, *p*=.274	*F*(2;457)=1.214; $_{\omega}$2=.001, *p*=.298

Note. N = 459. Age 1st = age of first-time using cannabis. Use Stat = self-identified cannabis use status. Phase = collection phase. * = p < . 05, ** = p < .01, *** = p < .001.

Research Question 2 – Attitudes Associated with Higher-Risk Behaviours

The second research question asks: are certain attitudes associated with higher-risk cannabis use, impaired driving, or impaired riding? Specifically, three hypotheses predicted that personal cannabis use (P5A-PCU), personal impaired driving (P7-IPA), and impaired driving acceptability (P8-IA) Attitude Index scores will be correlated with higher-risk cannabis use (O1-HRU), impaired driving (O2-ID), and impaired riding (O3-IR) Behaviour Index scores, respectively.

Associations were assessed via Pearson's *R* correlations and can be found in Table 19, which presents *R* and significance levels for correlations among variables of interest. Testing found that all three hypotheses, relating to research question 2, were supported. Results suggest certain attitudes are associated with higher-risk cannabis-related behaviours.

Hypothesis 2.1 – Personal Cannabis Use Attitudes Associated with Higher-Risk Cannabis Use

As predicted, P5A-PCU Attitude Index scores were negatively associated with O1-HRU Behaviour Index scores (i.e., problematic personal use attitudes were positively associated with O1-HRU scores; $p < .001$). Hypothesis 2.1 was supported. as the critical test value was significant and matched the predicted directionality.

Hypothesis 2.2 – Personal Impaired Driving Attitudes Associated with Impaired Driving

As predicted, P7-IPA Attitude Index scores were positively correlated with O2-ID Behaviour Index scores ($p < .001$). Hypothesis 2.2 was supported. as the critical test value was significant and matched the predicted directionality.

Hypothesis 2.3 –Impaired Driving Acceptability Attitudes Associated with Impaired Riding

As predicted, P8-IA Attitude Index scores were positively correlated with O3-IR

Behaviour Index scores ($p < .001$). Hypothesis 2.3 was supported. as the critical test value was significant and matched the predicted directionality.

Table 19

Correlations for Attitude Indexes with Behaviour Indexes and Individual Risk Behaviours

Var.	1. O1	2. O2	3. O3	4. DAD	5. Smk	6. Tob	7. Alc	8. CBD	9. THC	10. RCID	11. CID
12. P1A	.36***	.07	.27***	.25***	.05	.09	.22***	.03	.15**	.26***	.20***
13. P1B	.33***	.02	.21***	.26***	.08	.09	.15**	-.01	.21***	.21***	.14**
14. P2A	.06	-.01	-.01	.02	-.04	-.01	.06	.11	.06	-.02	-.07
15. P2B	-.02	-.16**	-.17***	-.07	-.07	.02	-.02	.06	.03	-.19***	-.11*
16. P2C	-.02	-.07	-.03	-.06	-.02	-.03	-.04	.05	-.07	-.05	-.05
17. P2D	.10*	-.08	.03	.03	-.01	-.01	.12*	.02	.12*	-.02	-.04
18. P3	.12*	-.01	.07	.12*	-.00	.09	.04	.03	.06	.01	.04
19. P4	.06	-.07	-.08	-.01	-.00	.10*	.00	.11*	.05	.05	-.01
20. P5A	-.47***	-.12*	-.08	-.45***	-.07	-.23***	-.17***	-.05	-.20***	-.12*	-.26***
21. P5B	-.18***	.09	-.07	-.07	.08	-.19***	-.09	-.05	-.07	-.01	-.04
22. P6	-.23***	-.18***	-.26***	-.19***	-.09	-.12*	-.09	-.05	.01	-.21***	-.19***
23. P7	.31***	.34***	.21***	.23***	.12*	.11	.09	-.00	.01	.15**	.31***
24. P8	.27***	.24***	.48***	23***	.14**	.17***	-.17***	-.04	.08	.38***	.31***

Note. N = 459. DAD = Daily or almost daily use. Smk = Smoking as main mode of consumption. Tob = Used tobacco with cannabis. Alc = Used alcohol with cannabis. CBD = Never uses CBD-dominant cannabis products. THC = Unaware of THC content in cannabis used. RCID = Rode with a cannabis-impaired driver. CID = Drove under the influence of cannabis. * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Research Question 3 - Attitudes Predictive of Higher-Risk Cannabis Use

The third research question was: do certain attitudes predict higher-risk cannabis use, impaired driving, or impaired riding behaviours? Specifically, three hypotheses predicted that personal cannabis use (P5A-PCU), personal impaired driving (P7-IPA), and impaired driving acceptability (P8-IA) Attitude Index scores will be predictive of higher-risk cannabis use (O1-HRU), impaired driving (O2-ID), and impaired riding (O3-IR) Behaviour Index scores, respectively.

Predictiveness of attitudes was assessed via three, two-step hierarchical multiple linear regressions, with higher-risk cannabis use (O1-HRU), impaired driving (O2-ID), and impaired riding (O3-IR) Behaviour Index scores as the dependent variables. Testing found that all three hypotheses, relating to research question 3, were supported. Results suggest certain attitudes are not only correlated with, but uniquely predict various higher-risk cannabis-related behaviours. Tables 20, 21, and 22 present regression coefficients and increments of change (i.e., *B*, *SE* (for *B*), β, 95% CIs for *B* (Lower, Upper), *t*, *R*, R^2, ΔR^2, *F*, and ΔF), as well as all significant stepwise and predictor variable *p*-values, for O1-HRU, O2-ID, and O3-IR, respectively.

Hypothesis 3.1 – Personal Cannabis Use Attitudes Predict Higher-Risk Cannabis Use

The regression model predicting higher-risk cannabis use (O1-HRU) Behaviour Index scores was statistically significant**,** F (27, 388) = 12.516, $p < .001$ (see Table 23). The Nagelkerke R^2 suggested that the model accounted for approximately 45.7% of the total variance. In step 1, analysis of O1-HRU scores revealed that demographics and user group memberships contributed significantly to the regression model, F (14, 388) = 5.353, $p < .001$, and accounted for 18.3% of the variance in O1-HRU scores. Specifically predictive were

recreational user status ($p < .001$), younger age of first use ($p < .001$), and higher Openness to Experience ($p = .002$).

In step 2, adding Attitude Index scores significantly explained a further 27.4% of variance, F (13, 388) = 10.042, $p < .001$. In the final model, significantly predictive demographic and user group variables were recreational use status ($p < .001$) and younger age of first cannabis use ($p = .011$). Significantly predictive Attitude Indexes were Cannabis Regulation support (P1A-CR; $p = .024$) , Relative Cannabis Risk (P1B-RCR; $p = < .001$), Impaired Driving Dangerousness (P7-ID; $p = .002$), and, as hypothesized, Personal Cannabis Use (P5A-PCU; $p < .001$). Therefore, as the hypothesized critical value was significant, hypothesis 3.1 was supported. Analysis suggests personal problematic cannabis use attitudes, uniquely predict higher-risk cannabis use behaviours.

Table 20

Hierarchical Linear Regression for Higher-Risk Cannabis Use Index Scores – Predictive Variables Only

Variable	B	SE	*β*	Lower	Upper	*p*	*t*	*R*	R^2	ΔR^2	*F*	Δ*F*	Step *p*
Step 1	-	-	-	-	-	-	-	.428	.183	.183	5.353	5.353	<.001
UseStat	-2.924	.547	-.276	-4.000	-1.848	<.001	-5.346	-	-	-	-	-	-
Age1st	-.422	.090	-.243	-.600	-.245	<.001	-4.675	-	-	-	-	-	-
BFI-O	.141	.044	.163	.053	.228	.002	3.163	-	-	-	-	-	-
Constant	18.230	3.001	-	12.326	24.134	<.001	6.074	-	-	-	-	-	-
Step 2	-	-	-	-	-	-	-	.676	.457	.274	10.042	12.516	<.001
UseStat	-2.143	.467	.102	-3.061	-1.225	<.001	-4.591	-	-	-	-	-	-
Age1st	-.205	.080	.042	-.363	-.048	.011	-2.567	-	-	-	-	-	-
P1A-CR	.072	.032	.026	.010	.134	.024	2.271	-	-	-	-	-	-
P1B-RCR	.173	.041	-.169	.092	.253	<.001	4.233	-	-	-	-	-	-
P5A-PCU	-.274	.036	-.010	-.344	-.204	<.001	-7.662	-	-	-	-	-	-
P7-IPA	.103	.033	.397	.039	.167	.002	3.155	-	-	-	-	-	-
Constant	16.817	3.426	-	10.078	23.556	<.001	4.909	-	-	-	-	-	-

Note. Durban-Watson = 1.179. Age1st = age of first-time using cannabis. UseStat = self-identified cannabis use status. BFI-O = Openness-to-experience.

Hypothesis 3.2 – Personal Impaired Driving Attitudes Predict Impaired Driving

The regression model predicting impaired driving (O2-ID) Behaviour Index scores was statistically significant, F (27, 277) = 3.613, $p < .001$ (see Table 24). The Nagelkerke R^2 suggested that the model accounted for approximately 28.1% of the total variance. Analyses of O2-ID scores revealed that demographics and user group memberships contributed significantly to the regression model, F (14, 277) = 2.618, $p < .001$, and accounted for 12.2% of the variance in O2-ID scores. In step 1, specifically predictive variables were higher personal income (p = .002), recreational user status (p =.003), younger age of first cannabis use ($p < .001$), lower Agreeableness (p = .042), and higher Neuroticism (p = .003).

In step 2, adding Attitude Index scores significantly explained a further 15.8% of variance, F (13, 277) = 4.233, $p < .001$. In the final model, significant predictor variables were higher personal income (p = .002), recreational user status (p = .013), younger age of first cannabis use (p = .030), higher Neuroticism (p = .003), lower support for Law Enforcement Preparedness for Legalization (P2B-LP; p = .037), lower support for Law Enforcement Ability to Recognize CID (P2D-LIR; p = .046), lower perceived Impaired Driving Dangerousness (P6-ID; p = .028) and, as hypothesized, higher perceived Personal Ability to Drive Impaired (P7-IP; $p < .001$). Therefore, as the hypothesized critical value was significant, hypothesis 3.2 was supported. Analysis suggests perceived personal ability to drive impaired, uniquely predicted impaired driving behaviours.

Table 21

Hierarchical Linear Regression for Impaired Driving Index Scores – Predictive Variables Only

Variable	B	SE	β	Lower	Upper	p	t	R	R^2	ΔR^2	F	ΔF	Step p
Step 1	-	-	-	-	-	-	-	.392	.153	.153	3.404	3.404	<.001
PersInc	.294	.093	.199	.111	.477	.002	3.163	-	-	-	-	-	-
UseStat	-2.218	.734	-.180	-3.664	-.772	.003	-3.020	-	-	-	-	-	-
Age1st	-.472	.124	-.226	-.716	-.227	<.001	-3.797	-	-	-	-	-	-
BFI-A	-.192	.094	-.133	-.377	-.007	.042	-2.047	-	-	-	-	-	-
BFI-N	.224	.074	.219	.079	.370	.003	3.034	-	-	-	-	-	-
Constant	14.876	3.977	-	7.046	22.706	<.001	3.741	-	-	-	-	-	-
Step 2	-	-	-	-	-	-	-	.543	.295	.142	3.875	3.864	<.001
PersInc	.284	.090	.192	.108	.460	.002	3.173	-	-	-	-	-	-
UseStat	-1.771	.711	-.144	-3.170	-.371	.013	-2.492	-	-	-	-	-	-
Age1st	-.272	.124	-.130	-.516	-.027	.030	-2.188	-	-	-	-	-	-
BFI-N	.219	.073	.214	.074	.363	.003	2.981	-	-	-	-	-	-
P2B-LP	-.184	.088	-.148	-.357	-.011	.037	-2.100	-	-	-	-	-	-
P2D-LIR	-.091	.046	-.133	-.181	-.002	.046	-2.003	-	-	-	-	-	-
P6-ID	-.110	.050	-.142	-.209	-.012	.028	-2.214	-	-	-	-	-	-
P7-IP	.212	.048	.267	.116	.307	<.001	4.376	-	-	-	-	-	-
Constant	15.178	5.084	-	5.165	25.191	.003	2.985	-	-	-	-	-	-

Note. Durban-Watson = 2.062 PersInc = personal income. Age 1st = age of first-time using cannabis. Use Stat = self-identified cannabis use status. BFI-A = Agreeableness. BFI-N = Neuroticism.

Hypothesis 3.3 – Impaired Driving Acceptability Attitudes Predict Impaired Riding

The regression model predicting impaired riding (O3-IR) Behaviour Index scores was statistically significant, F (27, 349) = 7.496, $p < .001$ (see Table 25). The Nagelkerke R^2 suggested that the model accounted for approximately 38.6% of the total variance. Analyses of O3-IR scores revealed that demographics and user group memberships contributed significantly to the regression model, F (14, 349) = 4.585, $p < .001$, and accounted for 16.1% of the variance in O3-IR scores. Specifically predictive variables were older age ($p = .006$), younger age of first use ($p < .001$), post-legalization collection phase ($p = .049$), and higher Extraversion ($p = .012$).

In step 2, adding Attitude Index scores significantly improved the model, F (13, 349) = 9.083, $p < .001$, explaining 22.5% more variance. In the final model, significant predictor variables were older age ($p = .046$), higher personal income ($p = .022$), younger age of first use ($p <.001$), post-legalization collection phase ($p = .050$), higher Extraversion ($p = .025$), lower support for Law Enforcement Preparedness for Legalization (P2B-LP; $p = .015$), lower perceived Impaired Driving Dangerousness (P6-ID; $p = .013$) and, as hypothesized, higher perceived Impaired Driving Acceptability (P8-IA; $p < .001$). Therefore, as the hypothesized critical value was significant, hypothesis 3.3 was supported. Analysis suggests perceived acceptability of driving impaired, uniquely predicted impaired riding behaviours.

Table 22

Hierarchical Linear Regression for Impaired Riding Index Scores – Predictive Variables Only

Variable	B	SE	*β*	Lower	Upper	*p*	*t*	*R*	R^2	ΔR^2	*F*	Δ*F*	Step *p*
Step 1	-	-	-	-	-	-	-	.387	.149	.149	4.204	4.204	<.001
Age	.083	.030	.167	.024	.141	.006	2.768	-	-	-	-	-	-
Age 1st	-.240	.040	-.317	-.319	-.161	<.001	-5.976	-	-	-	-	-	-
Phase	.508	.257	.105	.002	1.013	.049	1.974	-	-	-	-	-	-
BFI-E	.050	.020	.134	.010	.090	.015	2.434	-	-	-	-	-	-
Constant	3.388	1.336	-	.760	6.017	.012	2.536	-	-	-	-	-	-
Step 2	-	-	-	-	-	-	-	.613	.376	.226	7.177	8.977	<.001
Age	.055	.028	.112	.001	.109	.046	2.003	-	-	-	-	-	-
PersInc	.064	.028	.113	.009	.119	.022	2.294	-	-	-	-	-	-
Age 1st	-.139	.037	-.183	-.212	-.065	<.001	-3.710	-	-	-	-	-	-
Phase	.464	.236	.096	.000	.928	.050	1.967	-	-	-	-	-	-
BFI-E	.041	.018	.110	.005	.077	.025	2.257	-	-	-	-	-	-
P2B-LP	-.067	.027	-.142	-.026	.040	.015	-2.453	-	-	-	-	-	-
P6-ID	-.040	.016	-.134	-.071	-.008	.013	-2.494	-	-	-	-	-	-
P8-IA	.594	.087	.352	.423	.765	<.001	6.846	-	-	-	-	-	-
Constant	2.684	1.603	-	-.470	5.838	.095	1.674	-	-	-	-	-	-

Note. Durban-Watson = 2.046. Age 1st = age of first-time using cannabis. Phase = collection phase. PersInc = personal income. BFI-E = Extraversion.

Research Question 4 – Changes in Higher-Risk Behaviours since Legalization

The fourth research question was: did higher-risk cannabis use, impaired driving, or impaired riding behaviours increase after cannabis legalization? Specifically, three hypotheses predicted lower higher-risk cannabis use (O1-HRU), impaired driving (O2-ID), and impaired riding (O3-IR) Behaviour Index scores, in the pre-legalization collection phase compared to either post-legalization collection phase.

Index score changes between collection phases were assessed via ANOVAs. Significant differences between pre-legalization (Phase I), post-legalization/mid-Covid-19 (Phase II), and post-legalization/post-Covid-19 (Phase III) scores were identified via Bonferroni post-hoc analysis. Testing found that zero of the three hypotheses, relating to research question 4, were supported. Results suggest that higher-risk cannabis use, impaired driving, and impaired riding behaviours have not significantly increased since pre-legalization. Table 18 presents *M, SD, F*, ω2, and *p*-value for Index scores of collection phase groups.

Hypothesis 4.1 – Higher-Risk Cannabis Use Increased since Legalization

It was predicted that O1-HRU Behaviour Index scores would be higher in post-legalization collection phases (II or II) than in the pre-legalization collection phase (I). Data did not suggest any increase in O1-HRU scores since legalization. The critical value was not significant, therefore hypothesis 4.1 was not supported.

Hypothesis 4.2 - Impaired Driving Increased since Legalization

It was predicted that O2-ID Behaviour Index scores would be higher in post-legalization collection phases (II or II) than in the pre-legalization collection phase (I). Data did not suggest any increase in O2-ID scores since legalization. The critical value was not significant, therefore hypothesis 4.2 was not supported.

Hypothesis 4.3 – Impaired Riding Increased since Legalization

It was predicted that O3-IR Behaviour Index scores would be higher in post-legalization collection phases (II or II) than in the pre-legalization collection phase (I). Data did not suggest any increase in O3-IR scores since legalization. The critical value was not significant, therefore hypothesis 4.3 was not supported.

Additional Analyses

Differences in Individual Risks among Groups

Chi-Square Tests of Independence were conducted to examine group memberships and reporting of individual cannabis risk behaviours. Significantly higher scoring groups were identified via Bonferroni post-hoc analysis. Tables 23 and 24 present %, *N*, $\chi 2$, *df*, *V*, and *p*-value for groups and individual risks.

More females reported mixing alcohol with cannabis than males ($p = .017$). More 21- to 24-year-olds consumed cannabis via smoking modes than 17- to 20-years-olds ($p = .016$). More 17- to 20-year-olds reported mixing alcohol with cannabis than 21- to 24-year-olds and 29-year-olds or older ($p = .037$, $p <. 001$; respectively). Ethnic Europeans and Asians were more likely to report mixing alcohol and cannabis than ethnic Americans ($p <. 001$, $p = .025$; respectively). More ethnic Europeans also reported mixing alcohol with cannabis than ethnic Africans ($p = .037$).

Table 23

Prevalence of Higher-Risk Individual Behaviours within Demographic Groups

	Cannabis Use						Impaired Driving	
Group	DAD % *(N)*	Mode % (*N)*	TMix % (*N)*	AMix % (*N)*	CBD % (*N)*	THC % (*N)*	RCID % (*N)*	CID % (*N)*
Gender								
Female	22.9% (74)	66.1% (218)	17.9% (59)	66.7% (222)	61.5% (203)	38.2% (126)	53.6% (177)	26.4% (87)
Male	25.0% (23)	68.4% (65)	23.2% (22)	54.7% (52)	68.4% (65)	34.7% (33)	47.4% (45)	32.6% (31)
Stats	$\chi2$ (1)=0.163; *V*=.020, *p*=.687	$\chi2$ (1)=0.172; *V*=.020, *p*=.678	$\chi2$ (1)=1.167; *V*=.052, *p*=.280	$\chi2$ (1)=5.665; *V*=.114, *p*=.017*	$\chi2$ (1)=1.089; *V*=.052, *p*=.297	$\chi2$ (1)=0.551; *V*=.037, *p*=.458	$\chi2$ (1)=1.325; *V*=.055, *p*=.250	$\chi2$ (1)=1.359; *V*=.056, *p*=.244
Age								
17-20	21.5% (48)	60.1% (134)	20.6% (47)	72.2% (164)	67.4% (151)	41.7% (93)	40.9% (97)	20.8% (49)
21-24	23.6% (29)	74.8% (95)	16.3% (20)	56.9% (74)	61.3% (76)	34.7% (43)	57.0% (77)	24.8% (33)
25-28	29.6% (8)	80.0% (24)	20.0% (6)	58.1% (18)	61.3% (19)	31.1% (9)	58.1% (18)	28.1% (9)
29+	26.7% (8)	63.6% (21)	26.5% (9)	35.1% (13)	54.5% (18)	48.6% (17)	68.4% (26)	36.8% (14)
Stats	$\chi2$ (3)=1.191; *V*=.054, *p*=.755	$\chi2$ (3)=10.590; *V*=.160, *p*=.014*	$\chi2$ (3)=2.838; *V*=.082, *p*=.417	$\chi2$ (3)=23.095; *V*=.233, *p*<.001***	$\chi2$ (3)=2.907; *V*=.084, *p*=.406	$\chi2$ (3)=3.737; *V*=.095, *p*=.291	$\chi2$ (3)=16.386; *V*=.193, *p*<.001**	$\chi2$ (3)=5.064; *V*=.108, *p*=.167
Ethnicity								
African	15.4% (4)	60.7% (17)	14.3% (4)	42.8% (12)	75.0% (21)	51.9% (14)	41.9% (13)	13.3% (4)
American	20.0% (2)	44.4% (4)	10.0% (1)	9.1% (1)	36.4% (4)	36.3% (4)	45.5% (5)	18.2% (2)
Asian	39.5% (17)	67.4% (29)	30.2% (13)	51.1% (23)	62.2% (28)	28.6% (12)	44.7% (21)	12.8% (6)
European	22.2% (72)	68.1% (228)	18.7% (64)	68.8% (234)	65.7% (216)	39.3% (131)	51.6% (181)	26.4% (92)
Stats	$\chi2$ (3)=7.495; *V*=.136, *p*=.058	$\chi2$ (3)=2.745; *V*=.081, *p*=.433	$\chi2$ (3)=4.366; *V*=.102, *p*=.225	$\chi2$ (3)=26.385; *V*=.249, *p*<.001***	$\chi2$ (3)=5.417; *V*=.115, *p*=.144	$\chi2$ (3)=3.843; *V*=.096, *p*=.279	$\chi2$ (3)=1.774; *V*=.063, *p*=.621	$\chi2$ (3)=6.421; *V*=.121, *p*=.093

Note. N = 459. DAD = Daily (or almost daily) use. Mode = Smoking as main mode. TMix = Tobacco mixing. AMix = Alcohol mixing. CBD = CBD never use. THC = THC unawareness. RCID = Riding with a cannabis-impaired driver. CID = Cannabis-impaired driving. * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Individuals who began using cannabis between the ages of 9- and 15-years-old, compared to those who started at the age of 18-years-old or older, were more likely to report daily (or almost daily) use ($p = .027$), smoking as main mode of use ($p = .026$), mixing tobacco with cannabis ($p < .001$), riding with a cannabis-impaired driver ($p <. 001$), and cannabis-impaired driving ($p < .001$). Further, respondents that first used at 9- to 15-years-old, compared to 16-17-year-old first users, were more likely to report mixing of tobacco with cannabis ($p < .001$), riding with a cannabis-impaired driver ($p = .016$), and cannabis-impaired driving ($p = .040$). As well, 16-17-year-old first users, compared to 18-year-old or older first users, reported cannabis-impaired driving more often ($p = .039$).

More respondents who use cannabis both recreationally and medicinally report daily (or almost daily) use than recreational-only users ($p = .027$), medicinal-only users ($p = .037$), and "neither" users ($p < .001$). Recreational-only users were more likely to report daily (or almost daily) use than "neither" users ($p < .001$). More dual recreational and medicinal users mixed alcohol with cannabis compared to medicinal-only users ($p = .005$) and "neither" users ($p < .001$). Recreational-only users also reported mixing of alcohol with cannabis more than medicinal-only users ($p = .003$) and "neither" users ($p < .001$). "Neither" users reported less usage of CBD-only cannabis compared to dual recreational and medicinal users ($p = .015$). Further, "neither" users reported unawareness of THC content in cannabis used more often compared to recreational-only users ($p < .001$) and dual recreational and medicinal users ($p < .001$). More dual recreational and medicinal users reported cannabis-impaired driving than "neither" users ($p < .001$) and recreational-only users ($p = .029$). Lastly, more recreational-only users reported cannabis-impaired driving than "neither" users ($p = .004$).

Table 24

Prevalence of Higher-Risk Individual Behaviours within User Groups

	Cannabis Use						Impaired Driving	
Group	DAD % (*N*)	Mode % (*N*)	TMix % (*N*)	AMix % (*N*)	CBD % (*N*)	THC % (*N*)	RCID % (*N*)	CID % (*N*)
1stUse								
9-15	31.0% (39)	75.0% (98)	32.8% (43)	70.2% (87)	65.3% (81)	34.7% (43)	71.1% (96)	39.5% (53)
16-17	24.1% (32)	65.2% (90)	15.3% (21)	65.9% (87)	71.2% (94)	41.7% (55)	52.1% (73)	26.8% (37)
18+	17.0% (25)	60.0% (89)	12.0% (18)	60.7% (88)	56.6% (82)	36.6% (53)	33.6% (51)	10.4% (16)
Stats	$\chi2$ (2)=7.327; *V*=.134, *p*=.026*	$\chi2$ (2)=8.282; *V*=.141, *p*=.016*	$\chi2$ (2)=21.608; *V*=.227, *p*<.001***	$\chi2$ (2)=4.176; *V*=.102, *p*=.124	$\chi2$ (2)=2.937; *V*=.087, *p*=.230	$\chi2$ (2)=1.321; *V*=.058, *p*=.517	$\chi2$ (2)=40.413; *V*=.308, *p*<.001***	$\chi2$ (2)=33.009; *V*=.278, *p*<.001***
UseStat								
Neither	1.6% (1)	63.5% (47)	13.4% (11)	32.9% (27)	69.6% (55)	66.2% (51)	41.1% (39)	9.5% (9)
Rec	25.4% (72)	66.9% (190)	22.0% (63)	71.2% (205)	67.0% (185)	33.8% (94)	50.5% (144)	27.1% (77)
Med	11.1% (2)	61.1% (11)	5.0% (1)	27.3% (6)	47.6% (10)	42.9% (9)	32.0% (8)	4.2% (1)
Both	43.8% (21)	72.9% (35)	17.0% (8)	76.1% (35)	51.1% (24)	23.9% (11)	68.1% (32)	41.3% (19)
Stats	$\chi2$ (3)=30.427; *V*=.271, *p*<.001***	$\chi2$ (3)=1.432; *V*=.058, *p*=.698	$\chi2$ (3)=6.011; *V*=.118, *p*=.111	$\chi2$ (3)=56.216; *V*=.359, *p*<.001***	$\chi2$ (3)=8.009; *V*=.138, *p*=.046*	$\chi2$ (3)=31.651; *V*=.274, *p*<.001***	$\chi2$ (3)=12.385; *V*=.166, *p*=.006**	$\chi2$ (3)=25.475; *V*=.238, *p*<.001***
Phase								
2018	22.8% (26)	81.4% (96)	20.2% (24)	52.5% (64)	72.4% (84)	50.0% (59)	54.7% (70)	27.0% (34)
2019-20	25.2% (39)	72.2% (114)	18.7% (31)	63.6% (105)	66.9% (107)	41.4% (67)	50.0% (86)	23.8% (41)
2022	22.1% (32)	49.7% (74)	18.5% (28)	70.0% (105)	56.8% (84)	27.3% (39)	44.4% (68)	21.1% (32)
Stats	$\chi2$ (2)=0.433; *V*=.032, *p*=.805	$\chi2$ (2)=33.053; *V*=.279, *p*<.001***	$\chi2$ (2)=0.137; *V*=.018, *p*=.934	$\chi2$ (2)=8.951; *V*=.143, *p*=.011*	$\chi2$ (2)=7.453; *V*=.133, *p*=.024*	$\chi2$ (2)=14.646; *V*=.186, *p*<.001***	$\chi2$ (2)=2.959; *V*=.081, *p*=.228	$\chi2$ (2)=1.338; *V*=.055 *p*=.512

Note. *N* = 459. Age 1st = age of first-time using cannabis. Use Stat = self-identified cannabis use status. Phase = collection phase. DAD = Daily (or almost daily) use. Mode = Smoking as main mode. TMix = Tobacco mixing. AMix = Alcohol mixing. CBD = CBD never use. THC = THC unawareness. RCID = Riding with a cannabis-impaired driver. CID = Cannabis-impaired driving. * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Individual Risks Associated with Attitudes

See Table 19 for Pearson *r* correlations between individual risk behaviours and Attitude Index scores. Cannabis regulation (P1A-CR) Attitude Index scores were positively associated with daily (or almost daily) use ($p < .001$), mixing alcohol with cannabis ($p < .001$), THC unawareness ($p = .009$), riding with a cannabis-impaired driver ($p < .001$), and cannabis-impaired driving ($p < .001$). Cannabis use relative risk (P1B-RCR) Attitude Index scores were positively associated with daily (or almost daily) use ($p < .001$), mixing alcohol with cannabis ($p = .008$), THC unawareness ($p < .001$), riding with a cannabis-impaired driver ($p < .001$), and cannabis-impaired driving ($p = .009$). Perceived ability of law enforcement to recognize cannabis-impaired driving (P2D-LIR) Attitude Index scores were negatively correlated with riding with a cannabis-impaired driver ($p < .001$) and cannabis-impaired driving ($p = .032$). Support for government preparedness for cannabis legalization (P2A-GP) Attitude Index scores were positively correlated with mixing cannabis with alcohol ($p = .020$) and THC unawareness ($p = .021$). Support for the legalization of other drugs (P3-DL) Attitude Index scores were correlated with daily (or almost daily) use ($p = .027$). Knowledge source breadth (P4-KS) Attitude Index scores were positively correlated with mixing cannabis and tobacco ($p = .045$) and never using CBD ($p = .034$).

Personal cannabis use (P5A-PCU) Attitude Index scores were negatively correlated (note that lower index scores indicate higher problematic cannabis use) with daily (or almost daily) use ($p < .001$), mixing cannabis and tobacco ($p < .001$), mixing cannabis and alcohol ($p < .001$), THC unawareness ($p < .001$), riding with a cannabis-impaired driver ($p = .015$), and cannabis-impaired driving ($p < .001$). Personal alcohol use (P5B-PAU) Attitude Index scores were

negatively correlated (note that lower index scores indicate higher problematic alcohol use) with mixing cannabis and tobacco ($p < .001$).

Perceived dangerousness of impaired driving (P6-ID) Attitude Index scores were negatively correlated (note that lower index scores indicate lower perceived dangerousness) with daily (or almost daily) use ($p < .001$), mixing cannabis and tobacco ($p = .031$), riding with a cannabis-impaired driver ($p < .001$), and cannabis-impaired driving ($p < .001$). Personal ability to drive impaired (P7-IPA) Attitude Index scores positively were correlated with daily (or almost daily) use ($p < .001$), smoking as main consumption mode ($p = .034$), riding with a cannabis-impaired driver ($p = .009$), and cannabis-impaired driving ($p < .001$). Perceived acceptability of impaired-driving (P8-IA) Attitude Index scores were positively correlated with daily (or almost daily) use ($p < .001$), smoking as main consumption mode ($p = .007$), mixing cannabis and tobacco ($p < .001$), riding with a cannabis-impaired driver ($p < .001$), cannabis-impaired driving ($p < .001$), and negatively correlated with mixing cannabis and alcohol ($p < .001$).

Individual Risks Associated with Groups

Pearson correlations were investigated to further explore relations between index scores and groups of interest (see Table 25). Age and age of first cannabis usage were treated numerically, while gender (1 = male; 0 = female), ethnicity (1 = Ethnic European; 0 = Not Ethnic European), and user status (1 = recreational use only or dual recreational and medicinal use; 0 = medical only or “neither”) were dichotomized for correlations and subsequent logistic regression analyses.

Analysis found that female gender was correlated with mixing alcohol and cannabis ($p = .023$). European ethnicity was positively associated with mixing alcohol and cannabis ($p < .001$). Younger age was correlated with mixing alcohol and cannabis ($p < .001$) while older age was

correlated with riding with a cannabis-impaired driver ($p = .007$). Younger age of first using cannabis was associated with daily (or almost daily) use ($p < .001$), smoking as main mode of use ($p < .001$), mixing tobacco and cannabis ($p < .001$), mixing alcohol and cannabis ($p = .004$), riding with a cannabis-impaired driver ($p < .001$), and cannabis-impaired driving ($p < .001$). Recreational user status was positively correlated with daily (or almost daily) use ($p < .001$), mixing alcohol and cannabis ($p < .001$), and cannabis-impaired driving ($p < .001$). In addition, recreational user status was negatively associated with unawareness of THC content in cannabis used ($p < .001$).

Table 25

Correlations for Demographics with Attitude and Behaviour Indexes

Var.	1. Age	2. Sex	3. Eth	4. Edu	5. PIn	6 FIn	7. B5o	8. B5c	9. B5e	10. B5a	11. B5n	12. Age1	13. Rec	14. Leg
15. P1A	.06	-.03	-.23***	.02	-.02	.08	.17***	-.03	.09	.10*	.03	-.14**	-.18***	.10*
16. P1B	-.10*	.06	-.08	. -.07	-.05	-.04	.15**	.07	.05	.14**	.08	-.11*	-.04	-.05
17. P2A	-.09	-.06	-.03	-.08	-.03	.08	.09	.11*	-.05	.11*	.02	.09	-.09	.11*
18. P2B	-.16***	-.06	.06	-.06	.00	-.06	-.03	.03	-.02	.05	-.03	.11*	-.04	.06
19. P2C	-.06	-.00	.03	-.05	.02	.06	-.01	.18***	-.02	.10*	-.00	.07	-.01	.04
20. P2D	-.09*	-.03	-.00	-.04	-.06	.05	.09	.12*	.02	.12**	.05	.07	-.10*	.19***
21. P3	-.16***	-.07	.02	.07	-.08	-.09	.18***	-.13**	.01	-.04	-.04	.05	-.08	.13**
22. P4	.11*	.02	.02	-.04	.03	-.00	.11*	.08	.00	.05	-.00	.09	.00	.02
23. P5A	.07	.11*	-.10*	.05	.07	.03	-.18***	.13**	.09*	.13**	-.02	.04	.13**	-.08
24. P5B	.06	.10*	-.12*	.00	-.02	-.03	-.08	.03	.06	.15**	-.11*	.15**	.07	-.01
25. P6	-.02	-.00	-.11*	-.04	.02	.05	.05	.09*	-.12*	.20***	.15**	-.12**	.14**	.10*
26. P7	.01	-.09	.12*	.01	-.02	-.05	.09	-.12*	.05	-.17***	-.06	-.20**	-.07	-.03
27. P8	-.01	-.05	-.06	-.04	-.04	.04	.11*	-.11*	.05	-.01	.02	-.24***	-.10*	.01
28. O1	-.11*	.02	-.02	-.09	-.09	-.01	.18***	-.13**	.08	-.04	.05	-.20***	-.33***	.04
29. O2	.03	.02	-.08	-.05	.13*	.07	.05	.00	.07	-.03	.09	-.29***	-.17**	.09
30. O3	.12*	-.01	-.15**	-.02	.04	.01	.11*	-.10*	,12*	.00	.02	.17***	-.06	.04

Note. N = 459. Sex (1 = male, 2 = female). Eth = Ethnicity (1= European, 2 = non-European). Edu = Education (Edu; 1 = no degree or diploma, 2 = has degree or diploma). PIn = Personal Income, currently. FIn = Family Income, growing up. Age1 = Age Cannabis Use Initiated. Rec = Recreational Cannabis Use Status (1 = recreational user, 2 = non-recreational user). Leg = Legalization Phase (1 = pre-legalization, 2 = post-legalization). * = p < . 05, ** = p < .01, *** = p < .001.

Predicting Individual Risks

Eight, two-block hierarchical binary logistic regressions were conducted with each individual cannabis-related risk as the dependent variables. Tables 26-33 present all regression coefficients and increments of change (i.e., *B*, *SE* (for *B*), Wald test, Expβ, 95% CIs for Expβ (Lower, Upper), and Nagelkerke's pseudo R^2) as well as corresponding predictor-, block-, and model-wise *p*-values.

Daily (or Almost Daily) Cannabis Use. The regression model was statistically significant, $\chi 2$ (27, 336) = 164.574, $p < .001$ (see Table 26). The Nagelkerke R^2 suggested that the model accounted for approximately 70.4% of the total variance. Classification accuracy predicting daily (or almost daily) use had an overall correct classification rate of 92.9%. Non-daily (or almost daily) use had a higher correct classification (96.9%) than the correct classification of daily (or almost daily) use (67.4%).

Analyses revealed that correlated demographics and user group memberships contributed significantly to the regression model, $\chi 2$ (14, 336) = 61.092, $p < .001$, and accounted for 30.2% of the variance in daily (or almost) daily use. Specifically predictive variables in block 1 were lower personal income ($p = .003$) and younger age of first use ($p < .001$).

In the second block, adding Attitude Index scores explained a further 40.2% of the variance in daily (or almost) daily use, $\chi 2$ (13, $N = 336$) = 103.481, $p < .001$. In the final model, the significant predictor variables were lower personal income ($p = .002$), younger age of first use ($p = .006$), lower Agreeableness ($p = .004$), higher Neuroticism ($p = .019$), lower Cannabis Relative Risk attitudes (P1B-RCR; $p = .010$), higher problematic Personal Cannabis Use attitudes (P5A-PCU; $p < .001$), lower problematic Personal Alcohol Use attitudes (P5B-PAU; $p < .001$), and lower Impaired Driving Dangerousness attitudes (P6-ID; $p = .005$).

Table 26

Hierarchical Logistic Regression for Daily (or Almost Daily) Cannabis Use – Predictive Variables Only

						Expβ CI (95%)		*p*		Nagelkerke
Model	*B*	*SE*	Wald	*p*	Expβ	Lower	Upper	Block	Model	R^2
Block 1	-	-	-	-	-	-	-	<.001	<.001	.302
PersInc	-.170	.058	8.777	.003	.843	.753	.944	-	-	-
Age1st	-.350	.095	13.703	<.001	.704	.585	.848	-	-	-
Constant	-3.393	1.717	.658	.417	1.028	-	-	-	-	-
Block 2	-	-	-	-	-	-	-	<.001	<.001	.704
PersInc	-.332	.105	9.909	.002	.718	.584	.882	-	-	-
Age1st	-.447	.161	7.690	.006	.639	.466	.877	-	-	-
BFI-A	-.254	.089	8.115	.004	.776	.652	.924	-	-	-
BFI-N	.196	.083	5.542	.019	1.217	1.033	1.433	-	-	-
P1B-RCR	.174	.067	6.697	.010	1.190	1.043	1.358	-	-	-
P5A-PCU	-.301	.059	26.276	<.001	.740	.659	.830	-	-	-
P5A-PAU	.239	.068	12.498	<.001	1.271	1.113	1.451	-	-	-
P6-ID	-.126	.045	8.021	.005	.881	.808	.962	-	-	-
Constant	-5.503	2.279	.210	.647	.222	-	-	-	-	-

Note. Hosmer & Lemeshow: $\chi 2 = 1.788$; $p = .987$; Age 1st = age of first-time using cannabis. PersInc = personal income. BFI-O = Openness-to-experience.

Smoking as Main Mode of Consumption. The regression model was statistically significant, $\chi 2$ (27, 341) = 75.910, $p < .001$ (see Table 27). The Nagelkerke pseudo R2 suggested that the model accounted for approximately 27.5% of the total variance. Classification accuracy predicting smoking as main mode had an overall correct classification rate of 75.1%. Smoking as main mode had a higher correct classification (89.7%) than the correct classification of a non-smoking main mode (47.5%).

Analyses of smoking as main mode of cannabis use revealed that demographics and user group memberships contributed significantly to the regression model, $\chi 2$ (14, 341) = 66.986, $p < .001$, and accounted for 24.6% of the variance in smoking as main mode of cannabis use. In block 1, specifically predictive variables were lower personal income ($p = .020$), pre-legalization collection phase ($p < .001$), and younger age of first use ($p = .011$),

In block 2, adding Attitude Index scores did not significantly improve the model, $\chi 2$ (13, 341) = 8.925 $p = .779$, explaining 2.9% more variance. In the final model, significant predictor variables were lower personal income ($p = .044$), pre-legalization collection phase ($p < .001$), younger age of first use ($p = .047$), and lower problematic Personal Alcohol Use attitudes (P5B-PAU; $p = .045$).

Table 27

Hierarchical Logistic Regression for Smoking Cannabis – Predictive Variables Only

						Expβ CI (95%)		*p*		Nagelkerke
Model	*B*	*SE*	Wald	*p*	Expβ	Lower	Upper	Block	Model	R^2
Block 1	-	-	-	-	-	-	-	<.001	<.001	.246
PersInc	-.082	.035	5.395	.020	.921	.860	.987	-	-	-
Phase	-.961	.316	19.233	<.001	.382	.206	.711	-	-	-
Age1st	-.167	.049	6.491	.011	.846	.769	.931	-	-	-
Constant	3.476	1.400	6.165	.013	32.339	-	-	-	-	-
Block 2	-	-	-	-	-	-	-	<.001	<.001	.275
PersInc	-.073	.037	4.053	.044	.929	.864	.999	-	-	-
Phase	-1.030	.335	18.910	<.001	.357	.185	.689	-	-	-
Age1st	-.119	.052	3.574	.047	.866	.782	.959	-	-	-
P5B-PAU	.058	.021	4.033	.045	1.060	1.001	1.122	-	-	-
Constant	3.057	1.958	2.437	.119	21.269	-	-	-	-	-

Note. Hosmer & Lemeshow: $\chi 2 = 8.417$; $p = .417$; Age 1st = age of first-time using cannabis. PersInc = personal income. BFI-O = Openness-to-experience. Phase = collection phase.

Mixing with Tobacco. The regression model was statistically significant, $\chi 2$ (27, 343) = 83.199, $p < .001$ (see Table 28). The Nagelkerke pseudo R^2 suggested that the model accounted for approximately 33.8% of the total variance. Classification accuracy predicting mixing tobacco with cannabis had an overall correct classification rate of 81.9%. Not mixing tobacco with cannabis had a higher correct classification (94.9%) than the correct classification of mixing tobacco with cannabis (31.4%).

Analyses of mixing tobacco with cannabis revealed that correlated demographics and user group memberships contributed significantly to the regression model, $\chi 2$ (14, 343) = 53.091, $p <.001$, and accounted for 22.5% of the variance in mixing tobacco with cannabis. In block 1, Asian ethnicity ($p < .001$), recreational user status ($p = .042$), and younger age of first use ($p < .001$) were significantly predictive.

Adding Attitude Index scores significantly improved the model, $\chi 2$ (13, 343) = 30.108, $p = .005$, explaining 11.3% more variance in mixing tobacco with cannabis. In the final model, the significant predictor variables were Asian ethnicity ($p = .003$), younger age of first use ($p < .001$), lower Cannabis Relative Risk attitudes (P1B-RCR; $p = .049$), higher problematic Personal Cannabis Use attitudes (P5A-PCU; $p = .034$), and higher problematic Personal Alcohol Use attitudes (P5B-PAU; $p = .047$).

Table 28

Hierarchical Logistic Regression for Mixing with Tobacco – Predictive Variables Only

						Expβ CI (95%)		*p*		Nagelkerke
Model	*B*	*SE*	Wald	*p*	Expβ	Lower	Upper	Block	Model	R^2
Block 1	-	-	-	-	-	-	-	<.001	<.001	.225
Ethnicity	1.992	.510	15.269	<.001	.931	.203	1.301	-	-	-
UseStat	.987	.487	4.117	.042	.354	.175	.718	-	-	-
Age1st	-.324	.073	18.465	<.001	.730	.633	.843	-	-	-
Constant	2.982	1.732	1.309	.253	7.255	-	-	-	-	-
Block 2	-	-	-	-	-	-	-	<.001	<.001	.338
Ethnicity	1.607	.547	8.639	.003	.796	.143	1.299	-	-	-
Age1st	-.347	.084	16.901	<.001	.707	.599	.834	-	-	-
P1B-RCR	.066	.034	3.865	.049	1.069	1.000	1.142	-	-	-
P5A-PCU	-.053	.025	4.471	.034	.949	.903	.996	-	-	-
P5B-PAU	-.063	.032	3.690	.047	.939	.883	.999	-	-	-
Constant	4.021	1.888	1.020	.354	6.889	-	-	-	-	-

Note. Hosmer & Lemeshow: $\chi 2 = 6.461$; $p = .596$. Age 1st = age of first-time using cannabis. UseStat = self-identified cannabis use status. BFI-O = Openness-to-experience. Phase = collection phase.

Mixing with Alcohol. The regression model was statistically significant, $\chi 2$ (27, 344) = 122.027, $p < .001$ (see Table 29). The Nagelkerke pseudo R^2 suggested that the model accounted for approximately 41.4% of the total variance. Classification accuracy predicting mixing alcohol with cannabis had an overall correct classification rate of 79.7%. Mixing alcohol with cannabis had a higher correct classification (90.8%) than the correct classification of not mixing alcohol with cannabis (57.8%).

Analyses of mixing alcohol with cannabis revealed that correlated demographics and user group memberships contributed significantly to the regression model, $\chi 2$ (14, 344) = 100.500, $p < .001$, and accounted for 35.1% of the variance in mixing alcohol with cannabis. Specifically predictive variables in block 1 were younger age ($p < .001$), European ethnicity ($p = .015$), recreational user status ($p < .001$), lower Conscientiousness ($p = .045$), and higher Extraversion ($p = .007$).

In block 2, adding Attitude Index scores did not explain a significant amount of variance, adding a further 6.3% to the model, $\chi 2$ (13, 344) = 21.526, $p = .063$. Specifically, younger age ($p = .001$), female sex ($p = .026$), European ethnicity ($p = .017$), recreational user status ($p = .006$), lower Conscientiousness ($p = .037$), higher Extraversion ($p = .014$), and higher supportive attitudes towards Law Enforcement's Ability to Recognize CID (P2D-LIR; $p = .031$) were significantly predictive in the final model.

Table 29

Hierarchical Logistic Regression for Alcohol Mixing – Predictive Variables Only

						Expβ CI (95%)		*p*		Nagelkerke
Model	*B*	*SE*	Wald	*p*	Expβ	Lower	Upper	Block	Model	R^2
Block 1	-	-	-	-	-	-	-	<.001	<.001	.351
Age	-.115	.034	9.344	<.001	.891	.834	.952	-	-	-
Ethnicity	.891	.333	5.940	.015	.065	.007	.950	-	-	-
UseStat	1.478	.362	16.713	<.001	.448	.260	.772	-	-	-
BFI-C	-.058	.029	4.034	.045	.944	.892	.999	-	-	-
BFI-E	.069	.026	7.291	.007	1.076	1.019	1.126	-	-	-
Constant	3.041	1.450	4.398	.036	20.918	-	-	-	-	-
Block 2	-	-	-	-	-	-	-	<.001	<.001	.414
Age	-.125	.039	8.807	.001	.883	.819	.952	-	-	-
Sex	.882	.378	4.979	.026	.338	.161	.708	-	-	-
Ethnicity	1.029	.293	5.675	.017	.215	.061	.765	-	-	-
UseStat	1.626	.612	7.491	.006	.387	.108	.942	-	-	-
BFI-C	-.065	.026	4.353	.037	1.064	1.012	1.119	-	-	-
BFI-E	.067	.027	6.027	.014	1.048	1.006	1.092	-	-	-
P2D-LIR	.047	.022	4.662	.031	1.184	1.023	1.077	-	-	-
Constant	4.321	1.589	3.132	.409	11.298	-	-	-	-	-

Note. Hosmer & Lemeshow: $\chi 2 = 12.636$; $p = .125$. UseStat = self-identified cannabis use status. Phase = collection phase. BFI-C = Conscientiousness. BFI-E = Extraversion.

Non-Use of CBD. The regression model was statistically significant, $\chi 2$ (27, 332) = 60.614, p = .006 (see Table 30). The Nagelkerke pseudo R^2 suggested that the model accounted for approximately 22.8% of the total variance. Classification accuracy predicting non-use of CBD-dominant cannabis had an overall correct classification rate of 72.3%. Non-use of CBD-dominant cannabis had a higher correct classification (88.0%) than the correct classification of use of CBD-dominant cannabis (45.5%).

Analyses of non-use of CBD-dominant cannabis revealed that correlated demographics and user group memberships contributed significantly to the regression model, $\chi 2$ (14, 332) = 39.045, p = .020, and accounted for 15.1% of the variance in non-use of CBD-dominant cannabis. The only significantly predictive variable in block 1, was pre-legalization collection phase (p = .001).

In block 2, adding Attitude Index scores did not significantly improve the model, $\chi 2$ (13, 332) = 21.569, p = .062, explaining 7.7% more variance in non-use of CBD-dominant cannabis. In the final model, significant predictors were pre-legalization collection phase (p = .002) and higher supportive attitudes towards Government Preparedness for Legalization (P2A-GP; p = .032).

Table 30

Hierarchical Logistic Regression for CBD Non-Use – Predictive Variables Only

						Expβ CI (95%)		*p*		Nagelkerke
Model	*B*	*SE*	Wald	*p*	Expβ	Lower	Upper	Block	Model	R^2
Block 1	-	-	-	-	-	-	-	.019	.019	.151
Phase	1.023	.336	9.265	.001	2.782	1.440	5.377	-	-	-
Constant	4.058	1.352	8.010	.003	.017	-	-	-	-	-
Block 2	-	-	-	-	-	-	-	.046	.006	.228
Phase	1.078	.357	9.092	.002	2.138	1.458	5.921	-	-	-
P2A-GP	.048	.022	4.609	.032	1.052	1.014	1.793	-	-	-
Constant	3.879	2.006	3.738	.053	.021	-	-	-	-	-

Note. Hosmer & Lemeshow: $\chi 2 = 7.532$; $p = .480$. Phase = collection phase. UseStat = self-identified cannabis use status.

Unawareness of THC Content in Cannabis Used. The regression model was statistically significant, $\chi 2$ (27, 336) = 93.125, $p < .001$ (see Table 31). The Nagelkerke pseudo R^2 suggested that the model accounted for approximately 32.9% of the total variance. Classification accuracy predicting unawareness of THC content in cannabis used had an overall correct classification rate of 72.6%. Awareness of THC content in cannabis used had a higher correct classification (84.1%) than the correct classification of unawareness of THC content in cannabis used (54.3%).

Analyses of unawareness of THC content in cannabis used, revealed that demographics and user group memberships contributed significantly to the regression model, $\chi 2$ (14, 336) = 66.505, $p < .001$, and accounted for 24.4% of the variance in unawareness of THC content in cannabis used. Non-recreational or medicinal user status ("neither"; $p < .001$), pre-legalization collection phase ($p < .001$), and higher Openness to Experience ($p = .003$) variables were significantly predictive in block 1.

In block 2, adding Attitude Index scores significantly improved the model, $\chi 2$ (13, 336) = 26.520, $p = .014$, explaining 8.5% more variance in unawareness of THC content in cannabis used. In the final model, significant predictor variables were non-recreational or medicinal user status ("neither"; $p = .008$), pre-legalization collection phase ($p < .001$), higher Openness to Experience ($p = .049$), lower Cannabis Relative Risk attitudes (P1B-RCR; $p = .013$), lower supportive attitudes towards Law Enforcement's Ability to enforce CID Laws (P2C-LIP; $p = .001$), and higher problematic Personal Cannabis Use attitudes (P5A-PCU; $p = .015$).

Table 31

Hierarchical Logistic Regression for THC Unawareness – Predictive Variables Only

						Expβ CI (95%)		*p*		Nagelkerke
Model	*B*	*SE*	Wald	*p*	Expβ	Lower	Upper	Block	Model	R^2
Block 1	-	-	-	-	-	-	-	<.001	<.001	.244
Phase	1.794	.273	15.698	<.001	2.211	1.294	3.777	-	-	-
UseStat	1.627	.263	17.435	<.001	.534	.319	.895	-	-	-
BFI-O	.074	.022	8.816	.003	1.077	1.035	1.124	-	-	-
Constant	-1.042	1.294	.648	.421	.353	-	-	-	-	-
Block 2	-	-	-	-	-	-	-	<.001	<.001	.329
Phase	.712	.305	12.452	<.001	2.037	1.121	3.702	-	-	-
UseStat	-.683	.288	7.021	.008	.505	.287	.888	-	-	-
BFI-O	.052	.024	3.838	.049	1.053	1.005	1.103	-	-	-
P1B-RCR	.073	.026	6.142	.013	1.075	1.023	1.131	-	-	-
P2C-LIP	-.081	.023	10.858	.001	.922	.882	.964	-	-	-
P5A-PCU	-.070	.025	5.017	.015	.932	.888	.979	-	-	-
Constant	-1.583	1.948	.660	.416	.205	-	-	-	-	-

Note. Hosmer & Lemeshow: $\chi 2 = 3.714$; $p = .882$. Phase = collection phase. UseStat = self-identified cannabis use status. BFI-O = Openness-to-experience.

.

Riding with a Cannabis-Impaired Driver. The regression model was statistically significant, $\chi 2$ (27, 349) = 124.149, $p < .001$ (see Table 32). The Nagelkerke pseudo R^2 suggested that the model accounted for approximately 39.9% of the total variance. Classification accuracy predicting riding with a cannabis-impaired driver had an overall correct classification rate of 75.1%. Never riding with a cannabis-impaired driver had a similar correct classification (72.9%) to the correct classification of riding with a cannabis-impaired driver (77.1%).

Analyses of riding with a cannabis-impaired driver revealed that demographics and user group memberships contributed significantly to the regression model, $\chi 2$ (14, 349) = 63.789, $p < .001$, and accounted for 22.3% of the variance in riding with a cannabis-impaired driver. Specifically predictive variables in block 1 were older age ($p = .005$), younger age of first use ($p < .001$), and higher Openness to Experience ($p = .040$).

In block 2, adding Attitude Index scores significantly improved the model, $\chi 2$ (13, 349) = 60.360, $p < .001$, explaining 17.6% more variance in riding with a cannabis-impaired driver. In the final model, significant predictor variables were older age ($p = .018$), younger age of first use ($p = .002$), lower supportive attitudes towards Law Enforcement's Preparedness for Legalization (P2B-LP; $p = .008$), and higher supportive attitudes towards Impaired Driving Acceptability, generally and for others (P8-IA; $p < .001$).

Table 32

Hierarchical Logistic Regression for Riding with a Cannabis-Impaired Driver – Predictive Variables Only

						Expβ CI (95%)		*p*		Nagelkerke
Model	*B*	*SE*	Wald	*p*	Expβ	Lower	Upper	Block	Model	R^2
Block 1	-	-	-	-	-	-	-	<.001	<.001	.223
Age	.120	.037	7.951	.005	1.127	1.047	1.213	-	-	-
Age1st	-.236	.049	21.001	<.001	.790	.718	.870	-	-	-
BFI-O	.052	.021	4.227	.040	1.053	1.011	1.097	-	-	-
Constant	-.647	1.318	.241	.624	.524	-	-	-	-	-
Block 2	-	-	-	-	-	-	-	<.001	<.001	.399
Age	.116	.042	5.611	.018	1.123	1.035	1.218	-	-	-
Age1st	-.167	.052	9.617	.002	.846	.764	.937	-	-	-
P2B-LP	-.097	.037	7.127	.008	.908	.844	.976	-	-	-
P8-IA	.527	.127	16.418	<.001	1.693	1.321	2.171	-	-	-
Constant	-2.407	2.023	1.416	.234	.090	-	-	-	-	-

Note. Hosmer & Lemeshow: $\chi 2 = 6.956$; $p = .541$. Age 1st = age of first-time using cannabis. BFI-O = Openness-to-experience.

Cannabis-Impaired Driving. The regression model was statistically significant, $\chi 2$ (27, 349) = 132.811, $p < .001$ (see Table 33). The Nagelkerke pseudo R^2 suggested that the model accounted for approximately 46.6% of the total variance. Classification accuracy predicting cannabis-impaired driving had an overall correct classification rate of 81.7%. Never engaging in cannabis-impaired driving had a higher correct classification (92.3%) than the correct classification of cannabis-impaired driving (50.6%).

Analyses of cannabis-impaired driving revealed that correlated demographics and user group memberships contributed significantly to the regression model, $\chi 2$ (14, 349) = 84.597, $p < .001$, and accounted for 31.7% of the variance in cannabis-impaired driving. Specifically, older age ($p = .006$), recreational user status ($p = .007$), younger age of first use ($p < .001$), and higher Openness to Experience ($p = .022$) were significantly predictive in block 1.

In block 2, adding Attitude Index scores significantly improved the model, $\chi 2$ (13, 349) = 48.214, $p < .001$, explaining 14.9% more variance in cannabis-impaired driving. In the final model, significant predictor variables were older age ($p = .009$), recreational user status ($p = .018$), younger age of first use ($p < .001$), lower Extraversion ($p = .032$), higher problematic Personal Cannabis Use attitudes (P5A-PCU; $p = .039$), higher supportive attitudes towards Personal Ability to Drive Impaired (P7-IP; $p < .001$), and higher supportive attitudes towards Impaired Driving Acceptability, generally and for others (P8-IA; $p = .029$).

Table 33

Hierarchical Logistic Regression for Cannabis-Impaired Driving – Predictive Variables Only

						Expβ CI (95%)		*p*		Nagelkerke
Model	*B*	*SE*	Wald	*p*	Expβ	Lower	Upper	Block	Model	R^2
Block 1	-	-	-	-	-	-	-	<.001	<.001	.317
Age	.096	.037	7.502	.006	1.101	1.023	1.184	-	-	-
UseStat	-.779	.325	7.313	.007	.459	.243	.867	-	-	-
Age1st	-.392	.069	28.688	<.001	.676	.591	.774	-	-	-
BFI-O	.074	.026	5.236	.022	1.077	1.024	1.132	-	-	-
Constant	2.211	1.678	1.735	.188	9.124	-	-	-	-	-
Block 2	-	-	-	-	-	-	-	<.001	<.001	.466
Age	.109	.043	6.806	.009	1.116	1.025	1.215	-	-	-
Age1st	-.337	.076	16.424	<.001	.714	.615	.829	-	-	-
BFI-E	-.070	.031	4.582	.032	.933	.878	.990	-	-	-
P5A-PCU	-.058	.025	4.254	.039	.943	.898	.991	-	-	-
P7-IPA	.094	.022	17.859	<.001	1.098	1.051	1.147	-	-	-
P8-IA	.293	.130	4.748	.029	1.341	1.039	1.730	-	-	-
Constant	.416	2.711	.024	.878	1.516	-	-	-	-	-

Note. Hosmer & Lemeshow: $\chi 2 = 9.354$; $p = .313$. Age 1st = age of first-time using cannabis. UseStat = self-identified cannabis use status. BFI-O = Openness-to-experience. BFI-E = Extraversion.

Changes in Individual Risks since Legalization

Differences in scores across time were assessed via Chi-Square Tests of Independence, with Bonferroni post-hoc analyses (see Table 24). Respondents in Phase I, compared to Phase III, were more likely to report smoking as main mode of use (p <.001), non-usage of CBD-dominant cannabis (p = .024) and unawareness of THC content in cannabis used (p <.001). Phase II respondents, compared to Phase III users, were more likely to report smoking as main mode of use (p = .001). Phase III users reported more mixing of alcohol with cannabis than Phase I users (p = .006). Results from additional analyses are used to add further context to the main findings of the hypotheses tests and subsequent interpretations.

Discussion

Support of Research Questions and Hypotheses

Research questions aimed to (1) determine if higher-risk cannabis use, impaired driving, or impaired riding behaviours were more common in individuals who began using cannabis at a young age; (2) identify certain attitudes associated with higher-risk cannabis use, impaired driving, or impaired riding behaviours; (3) identify certain attitudes predictive of higher-risk cannabis use, impaired driving, or impaired riding behaviours; and (4) determine if higher-risk cannabis use, impaired driving, or impaired riding behaviours increased after cannabis legalization. Prior to the main analysis, the Cannabis Legalization Impact Questionnaire (CLIQ) was developed, refined, and utilized for data collection. The four research questions were investigated via three hypotheses per question. Findings from hypotheses testing fully supported the investigation of all research goals, as (1) risks were higher among cannabis users who began use at a younger age, (2) anticipated attitudes and behaviors were closely correlated, (3) attitudes predicted risk behaviours when controlling for all relevant variables, and (4) cannabis-related

risks, in general, did not increase after legalization.

Research Question 1

Corresponding to the first research goal, hypotheses 1.1-1.3 correctly predicted users who began cannabis use before age 18 will have higher higher-risk cannabis use (O1-HRU), impaired driving (O2-ID), and impaired riding (O3-IR) Behaviour Index scores, compared to those who began cannabis use after the age of 18.

Research Question 2

Corresponding to the second research goal, hypotheses 2.1-2.3 correctly predicted that personal cannabis use (P5A-PCU), personal impaired driving (P7-IPA), and impaired driving acceptability (P8-IA) Attitude Index scores will be correlated with higher-risk cannabis use (O1-HRU), impaired driving (O2-ID), and impaired riding (O3-IR) Behaviour Index scores, respectively.

Research Question 3

. Corresponding to the third research goal, hypotheses 3.1-3.3 correctly predicted that personal cannabis use (P5A-PCU), personal impaired driving (P7-IPA), and impaired driving acceptability (P8-IA) Attitude Index scores will be predictive of higher-risk cannabis use (O1-HRU), impaired driving (O2-ID), and impaired riding (O3-IR) Behaviour Index scores, respectively.

Research Question 4

Corresponding to the fourth research goal, hypotheses 4.1-4.3 incorrectly predicted lower higher-risk cannabis use (O1-HRU), impaired driving (O2-ID), and impaired riding (O3-IR) Behaviour Index scores, in the pre-legalization collection phase compared to either post-legalization collection phase.

Similarity of Results

Behaviours among Groups

Participant groups that engaged most often in impaired driving or riding behaviours were older aged users and users who first used at a very young age (i.e., first use before 16-years-old), as both groups consistently reported elevated rates of impaired driving-related behaviours, in line with previous survey data (Goodman & Hammond, 2022; Rotermann, 2021). Males and females were found to report similar levels of higher-risk cannabis use, impaired driving, and impaired riding behaviours. These null gender differences are contrary to prevailing agreement that males engage more often in risky cannabis use and impaired driving, although relative increases in female risk have been noted in recent years (Fischer et al., 2019; Kim et al., 2022; Sandhu et al., 2019).

Behaviours since Legalization

Since pre-legalization, higher-risk cannabis use, impaired driving, and impaired riding behaviours remained stable. Comparable research has been mixed; finding stability and also small sized changes in various directions for behaviours such as cannabis impaired driving, amount of cannabis typically purchased, amount per use, recency of use, or price of cannabis (Fischer et al., 2021; Mahamad et al., 2020).

Attitudes among Groups

Males expressed more supportive personal impaired driving attitudes than females. This is consistent with growing research that asserts risky attitudes towards impaired driving and cannabis-impaired driving are more prevalent in males than females (Leos-Toro et al., 2020; Malholtra et al., 2017; Windle et al., 2021). More investigation is needed, as differences in male and female impaired driving attitudes are not reliably found in some samples (Windle et al.,

2022). Between sexes, males reported attitudes indicating higher problematic personal cannabis and alcohol use, compared to females. Literature has dissimilarly found males did not report significantly more risky or personal problematic attitudes than females (Goodman et al., 2020), while other work similarly found that males reported more risky use attitudes and behaviours (Hellemans et al., 2019; Kolar et al., 2018).

Ethnic Europeans did not report significantly different attitudes towards relative cannabis use risk than any other ethnic group. Similarly, recent research found European ethnicity to be non-predictive of risky cannabis-related attitudes (Goodman et al., 2020), despite European ethnicity often being considered a risk factor for cannabis harm (Hall et al., 2023). Younger first users reported higher supportive attitudes for cannabis regulation, drug legalization, and impaired driving acceptability of others. Older first users reported higher supportive attitudes towards government preparedness for legalization, law enforcement preparedness for legalization, law enforcement ability to enforce and recognize cannabis-impaired driving, as well as general dangerousness of impaired driving. Younger first use is well-known covariate of cannabis-related risks (Fischer et al., 2021), and the present data replicates this relationship.

Attitudes since Legalization

The present analysis found post-legalization increases in support for law enforcement's ability to recognize cannabis-impaired driving, general dangerousness of impaired driving, and legalization of other drugs. In general, data appears similar to work indicating that Canadians are knowledgeable about cannabis risks and impaired driving (Cunningham, 2020; Ellis & Resko, 2022; Winstock et al., 2021). Current findings differ from American studies that show decreasing cannabis use-supportive attitudes over time, among young adults (Chiu et al., 2022). Canadian data, similar to American data, remains mixed regarding the effect of legalization on attitude

changes in users and the general public (Cunningham, 2020; Goodman & Hammond, 2022; Wadsworth & Hammond, 2019). Conversely, each cannabis use-related attitude index scores did not increase – which can be interpreted positively if current public awareness is deemed to be at an appropriately knowledgeable level (potentially, the case for some cannabis-related health or legal risks). Stability in attitudes can also be seen as an opportunity to increase public knowledge of risks and to continually educate the public, especially young adults.

Attitudes and Behaviours

Relative cannabis risk and personal problematic use attitudes were strongly associated with higher-risk cannabis use behaviours. Relations are similar to other research findings, such that risky attitudes and low knowledge were closely related to engaging in risk or harms (Ellis & Resko, 2022). General and personal attitudes related to impaired driving were strongly associated with impaired driving risks, congruent with literature suggesting supportive impaired driving attitudes are related to engaging in cannabis- and alcohol-impaired driving (Leos-Toro et al., 2020; McDonald et al., 2021; Shephard et al., 2023). Further fitting with present data, such that impaired driving attitudes were highly related to engaging in impaired driving, impaired driving engagement has been suggested to be facilitated by beliefs about limited impairment and consequences from impaired driving (Goodman & Hammond, 2022).

Interpretation

Additional analyses of individual risk behaviours were mined to elaborate on group, attitude, and behaviour relations found through hypotheses testing. Findings were interpreted via research aims with careful consideration of various potential biases, threats to validity, imprecise measurements, and appropriateness of the sample. Effect sizes related to critical findings are presented.

Risk Factors

By exhibiting how individual risks (some of which comprise the behaviour/outcome indexes) are related to and predicted by unique sets of risk factors, knowledge uptake potential is improved. Additional analyses of risks related to specific individual harms allowed for a more detailed interpretation of index-level hypotheses testing results. Group differences, correlations, and regressions using binary, past-year individual risk behaviours as dependant variables further explored relations among variables of interest. While not playing a role in hypothesis testing, additional analyses served to add robustness to potential takeaways from the main analyses. Public health and law enforcement stakeholders can better construct policy and screening measures via information on individual cannabis risks, on top of index-level measurements.

At-Risk Demographic Groups. More females mix alcohol with cannabis than males (V = .114). Alcohol mixing also differed among age groups (V = .233), with the youngest users (17-20-years-old) reporting the most. Riding with a cannabis-impaired driver was different among age groups (V = .193) and most common in older users. Smoking was also different among age groups (V= .160), with those between the ages of 21-28 reporting smoking the most. Ethnicities differed on alcohol mixing rates (V= .250), with Europeans reporting the most. The only individual risk outcome uniquely predicted by European ethnicity was mixing alcohol and cannabis.

At-Risk User Groups. Age of first use groups reported different rates of daily (or almost daily) use (V = .134), smoking as main mode (V = .141), tobacco mixing (V = .227), riding with a cannabis-impaired driver (V = .308), and cannabis-impaired driving (V = .278); younger first users reported higher rates compared to older first users. Risk outcomes uniquely predicted by younger age of first use included daily (or almost daily) use, smoking as main mode, mixing

tobacco, riding with a cannabis-impaired driver, and cannabis-impaired driving. Cannabis use status groups reported different rates of daily or almost daily use (V = .271), alcohol mixing (V = .359), CBD use (V = .178), THC awareness (V = .274), riding with a cannabis-impaired driver (V = .166), and cannabis-impaired driving (V = .238). Recreational users reported higher rates of individual risks compared to non-recreational users, except for CBD non-use and THC unawareness. Individual risk outcomes predicted by recreational use status were alcohol mixing, while non-recreational use status predicted THC content unawareness.

Attitudes that Predict Individual Risk Behaviours. Of all Attitude Indexes, personal problematic cannabis use attitudes predicted the most individual risks, including daily (or almost daily) use, tobacco mixing, THC unawareness, cannabis-impaired driving. Supportive attitudes towards acceptability of impaired driving uniquely predicted riding with a cannabis-impaired driving and cannabis-impaired driving. Results align with Theory of Planned Behaviour principles (Earle et al., 2020), such that intentions to engage in certain cannabis risk-relevant behaviours appear related to engaging in such a behaviour.

Findings suggest behavioural interventions are of increasing importance, as education and awareness of risks may only go so far in decreasing cannabis harms, especially within a legal and widely accessible cannabis market. Specifically, cannabis-related attitudes and individual risk behaviours ought to be investigated deeper, to better discern how behavioural interventions could best focus on preventing and reducing specific cannabis-related risks, especially daily (or almost daily) use, mixing with alcohol, mixing with tobacco, riding with a cannabis-impaired driver, and cannabis-impaired driving.

Individual Risk Behaviours since Legalization

Behaviour Index scores did not increase, as hypothesized. Additional analyses considered

changes in individual risks behaviours over time to further contextualize post-legalization changes (or lack of changes). The only result identifying an increasingly prevalent individual risk was a difference in mixing cannabis and alcohol (V = .143), which increased from 52.5% to 63.6% to 70.0% of users (from Phases I-III). The largest decrease in harm was a difference in reporting smoking as a main mode of use (V = .279), which decreased from 81.4% to 72.2% to 49.7% of users. CBD non-use and THC unawareness also became less prevalent, finding decreases in the proportion of users reporting these harms (V = .133, V = .186; respectively).

Additional analyses were utilized to more sensitively detail changes in risks since legalization, replicating various relationships found across the literature (i.e., younger first users report more risks) and identifying rates of risks within the sample. Results encouragingly displayed that, since legalization, users were smoking less, using CBD more, and were more aware of THC content. However, increasing rates of mixing with alcohol are concerning and ought to be better discouraged, especially in young users who already display elevated rates of poly-substance use. Covid-19 and related public health measures' influence on changes in cannabis-related behaviours remains difficult to discern and may confound various findings.

Generalizability

Sample and Setting

The participants were similar to the target population, such that sample validity was appropriate enough to conclude significant findings with meaningful effect sizes about at-risk Nova Scotian cannabis users. The sample was appropriately sized and comprised young adults in university, which captured many potentially at-risk subgroups of pre-planned interest. Localized data can be useful for applying findings to Nova Scotian (and similarly regulated jurisdictions) and for comparing interprovincial cannabis-related concerns. While the sample served the

purposes of the present investigation, much more diverse data ought to be collected to better capture generalizable findings on cannabis-related attitudes and behaviours. More males, ethnic non-Europeans, and older cannabis users should be considered in further research, as the present study (along with many others) does not have an equal representation of these demographics. A contextual issue influencing ecological validity was data being less utilizable for retail stakeholders, given the factors and analyses considered are not economically focused.

Method and Design

Procedures and materials used ought to be further evaluated in future investigations to fully determine how applicable the measures are, especially in real-world scenarios for frontline workers such as treatment providers and law enforcement. It is worth noting items and indexes were generated via evidence-based sources and procedures (Hinkin, 1998; Lazor et al., 2022), in addition to demonstrating internal validity and statistical utility. Indeed, cannabis-related risk measures were derived directly from widely distributed, best-practice tools for measuring cannabis-related attitudes, behaviours, and harms (Fischer et al., 2017; Lake et al., 2019; Lazor et al., 2022) – allowing for ease of survey design and potential replication. High-level uptake of these findings is compatible with researchers looking to investigate cannabis and substance use in Canada or internationally. Ground-level uptake may also occur, potentially via screening tools that consider the trends and profiles of risky or harmful cannabis use suggested by the data. Best practice recommendations for capturing indicators of attitudes towards law enforcement (Jackson et al., 2023) were generally met and captured by multiple Attitude Indexes. The present study presents attitudinal and behavioural data that were utilized to answer research goals, but further calibration of measures with data from a larger and more diverse sample would improve the generalizability of findings for police and other frontline stakeholders.

Legalization Context

Pre-legalization and post-legalization response sets provide this study with uniquely valuable data for analyzing cannabis-related legal topics. Data was continually collected over the course of five years, including the days and months both leading up to and following, Canadian federal legalization. Manipulation of cannabis legalization (and Covid-19, somewhat) via policy and law, albeit differently across Canada, was executed without question – allowing for a natural experiment involving an unprecedented change in law. Covid-19's role in how Canadians used cannabis during data collection must be considered when generalizing results. For researchers, and treatment providers these findings provide guidance and utility; but noted jurisdictional, policy-wise, and legal differences must be considered when translating findings into future legalization contexts.

Limitations and Strengths

Method

The study is subject to limitations typical of survey research, such as potential data quality and self-report concerns. In addition, respondents were recruited using non-probability-based sampling and did not provide provincially or nationally representative sample features, particularly given the inclusion of remote and/or non-Canadian students in our sample pool. The narrow pool of students from which data is drawn from remains a notable weakness of the study, as cannabis users represent a much wider population than captured in the present sample. Despite these limitations, the use of the online Qualtrics survey platform still provided a reliable form of recruitment and data collection, especially given the wide accessibility of internet-based survey completion options such as smartphones, tablets, or personal computers (Braunsberger et al., 2007). Further, the sample remained representative of at-risk, user groups of interest.

Data was collected via self-report procedures, which are known to be burdened by recall issues as well as social desirability bias. Even with this limitation, survey research is the most feasible method for assessing cannabis use, and by far the most common method, being used in most national and international benchmark cannabis use measures (Hammond et al., 2020). Aiming to decrease potential social desirability, the survey repeatedly notes the confidential and anonymous nature of participant responses. Additionally, qualitative data was used to check for ingenuine response sets, helping offset limitations from collection methods.

Design

Cross-sectional pre- to post-legalization measurement of cannabis prevalence brings about response limitations (and opportunities) related to changing legal and social norms. For instance, pre-legalization cannabis behaviours may be underreported, due to cannabis still being illegal. Post-legalization responses may be more accurate given a decrease in perceived potential negative consequences of admitting to using cannabis. Causal changes from legalization were not extrapolated from our data, although increases in THC content awareness and CBD product use are arguably due to retail policies related to increased product labelling and access.

Psychometrics

The CLIQ measurement instrument displayed various types of validity and utility, as shown in the survey design section and throughout the hypothesis testing analysis. However, improvements can be made on multiple fronts. A larger and more diverse sample could be used to further refine and detail attitudes of different user subgroups. Type 1 and Type 2 error rates did not appear problematic, potentially due to cautious analytic procedures leading to conservative decision making and interpretations, but future research should consider the preliminary and exploratory nature of the measures used.

Further, as new data identify emerging and fading trends in cannabis use, continual updating of definitions for behaviours, that were once considered risks, will be required. For example, THC unawareness may not be risky in the same way it was before legalization; unawareness used to be a mild and common harm for regular users and was related to access issues (Goodman & Hammond, 2022; Hall et al., 2023). However, it may be suggested that THC unawareness more closely relates to less-common risks for novice users, such as overuse (Hall et al., 2023). Risks ought to be updated and redefined, as research continues to determine cannabis-related behaviours that relate to public health problems. Also notably, the increasingly popular consumption mode of vaporizing is sometimes considered much less risky than smoking (Chadi et al., 2020). A lack of evidence for vaping-related risk is arguably not enough to recommend such a mode over smoking; at present, most all inhalation methods of cannabis should be communicated as harmful to physical health.

Risk definitions and operationalizations continually influence how behaviours should be generalized, interpreted, and measured; instruments at-hand were influenced by previous definitions of cannabis risk, a potential limit to this study in the medium- and long-term. As understanding of cannabis use grows, measures that once adhered to best practices may become inaccurate, without proper post-hoc investigation. One way psychometric limitations were addressed was by additional analyses extrapolating index-wise measurements to investigate novel individual risks.

Implications

Supports for Public Health Stakeholders

Researchers, treatment providers, law enforcement, and cannabis users can benefit from this research. Prevention and harm reduction of cannabis risk can be informed through results

highlighting trends in higher-risk cannabis use. High-level, protective implications can be useful for research, public health, programming, and policy work, by helping identify uniquely relevant groups and risks that ought to be targeted by services (Fischer et al., 2019). Ground-level, reactive implications can aid frontline stakeholder responses to cannabis risks in the community, a noted gap in cannabis research (Lazor et al., 2022). Treatment providers, law enforcement, and users benefit from findings on specific changes in risk trends, across groups and over time. This thesis empirically contributes to attitudinal research on cannabis, but more work is needed – as specific attitudes regarding law enforcement and governments could be further elaborated on. User interactions with law enforcement and attitudes related to cannabis-related laws, continue to grow in relevance (Greer et al., 2020) but deeper inquiry was not within the scope of the present thesis.

Takeaways for Cannabis Users

Especially relevant takeaways for users were related to consumption and impaired driving. Lower-risk cannabis use practices are known, but not necessarily available to be utilized by most users. For instance, cannabis use is best restricted to low THC strains, which may not be readily available (Kolar et al., 2018). As well, advocates suggest harm can be reduced by creating a social cannabis use culture, more similar to alcohol use. Recommendations for allowing legal public use can be difficult to evaluate as these spaces are not commonly available, despite isolated cannabis use being a known risk factor for harm (Hasin & Walsh, 2021). Theoretical, clinical, and practical utilization of these data must carefully consider sample characteristics, significance levels, effect sizes, and other statistics as the basis for inclusion in any future services aiming to reduce risk in cannabis users.

Functional Considerations for Future Work

Applications based on the present study are potentially warranted but must be considered within the context of present data being investigated in a Nova Scotia-based sample, which is a legal environment restricted to government retail and mostly, private cannabis consumption options. Relevant, measurable risk relations were confirmed and uncovered, but gaps in knowledge remain regarding users who report lower-risk attitudes yet still engage in higher-risk behaviours. Results imply that approaches to decreasing public health risks related to cannabis, via education and attitude change should be dynamic and adapt to trends in higher-risk use. Flexibility in risk factor targeting is imperative, as research over the course of legalization and Covid-19 has found a mix of stagnating, decreasing, and increasing risk behaviours, as well as risk-related attitudes.

C**onclusion**

As legalization plays out, investigation into changes in public health outcomes is required, including consideration of cannabis-related attitudes and behaviours. Countries around the world will continue to look to Canada for cutting-edge research on cannabis and the thesis at-hand aims to contribute to this literature base. Findings submit that (1) higher-risk cannabis use, impaired driving, and impaired riding behaviours were more common in individuals who began using cannabis at a young age; (2,3) measurable risk-related attitudes were associated and predictive of higher-risk cannabis use, impaired driving, and impaired riding behaviours; and (4) higher-risk cannabis use, impaired driving, and impaired riding behaviours did not increase after cannabis legalization. Further research on cannabis-related attitudes and behaviours is required to extend and apply lessons learned.

References

Agrawal, A., Neale, M. C., Prescott, C. A., & Kendler, K. S. (2004). A twin study of early cannabis use and subsequent use and abuse/dependence of other illicit drugs. *Psychological medicine, 34*(7), 1227-1237.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). https://doi.org/10.1176/appi.books.9780890425596

Appleby, J. A., King, N., Saunders, K. E., Bast, A., Rivera, D., Byun, J., ... & Duffy, A. C. (2022). Impact of the COVID-19 pandemic on the experience and mental health of university students studying in Canada and the UK: A cross-sectional study. *British Medical Journal, 12*(1), e050187.

Asbridge, M., Hayden, J. A., & Cartwright, J. L. (2012). Acute cannabis consumption and motor vehicle collision risk: Systematic review of observational studies and meta-analysis. *British Medical Journal, 344*, e536.

Azofeifa, A., Mattson, M. E., Schauer, G., McAfee, T., Grant, A., & Lyerla, R. (2016). National estimates of marijuana use and related indicators—national survey on drug use and health, United States, 2002–2014. *Morbidity and Mortality Weekly Report: Surveillance Summaries*, *65*(11), 1-25.

Balon, R. (2018). Illegal or legal, marijuana remains a gateway drug. *Focus*, *16*(4), 2s-3s.

Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of Social and Clinical Psychology*, *4*(3), 359.

Batalla, A., Bhattacharyya, S., Yuecel, M., Fusar-Poli, P., Crippa, J. A., Nogue, S., ... & Martin-Santos, R. (2013). Structural and functional imaging studies in chronic cannabis users: A systematic review of adolescent and adult findings. *PloS one*, *8*(2), e55821.

Borodovsky, J. T., Crosier, B. S., Lee, D. C., Sargent, J. D., & Budney, A. J. (2016). Smoking, vaping, eating: Is legalization impacting the way people use cannabis? *International Journal of Drug Policy*, *36*, 141-147.

Braunsberger, K., Wybenga, H., & Gates, R. (2007). A comparison of reliability between telephone and web-based surveys. *Journal of Business Research, 60*(7), 758-764.

Callaghan, R. C., Sanches, M., Benny, C., Stockwell, T., Sherk, A., & Kish, S. J. (2019). Who consumes most of the cannabis in Canada? Profiles of cannabis consumption by quantity. *Drug and Alcohol Dependence*, *205*, 107587.

Camchong, J., Lim, K. O., & Kumra, S. (2017). Adverse effects of cannabis on adolescent brain development: A longitudinal study. *Cerebral Cortex*, *27*(3), 1922-1930.

Chadi, N., Minato, C., & Stanwick, R. (2020). Cannabis vaping: Understanding the health risks of a rapidly emerging trend. *Paediatrics & Child Health*, *25*(1), 16-21.

Chiu, V., Hall, W., Chan, G., Hides, L., & Leung, J. (2022). A systematic review of trends in US attitudes toward cannabis legalization. *Substance Use & Misuse*, *57*(7), 1052-1061.

Chiu, V., Leung, J., Hall, W., Stjepanović, D., & Degenhardt, L. (2021). Public health impacts to date of the legalisation of medical and recreational cannabis use in the USA. *Neuropharmacology*, *193*, 108610.

Cloutier, A., Tremblay-Antoine, C., Dufresne, Y., & Fréchet, N. (2022). Highs and downs: A scoping review of public opinion about cannabis, alcohol and tobacco in Canada. *Drug and Alcohol Review*, *41*(2), 396-405.

Cooke, M., Milicic, S., MacDonald, J.A., Asbridge, M., Guindon, E., Muhajarine, N., … & U., Burkhalter. (2020). *Provincial Patterns and Trends of Cannabis Use among Youth: Nova Scotia. Ottawa, Ontario, Canada.* Canadian Centre for Substance Use and Addiction.

Copeland, J., & Swift, W. (2009). Cannabis use disorder: Epidemiology and management. *International Review of Psychiatry*, *21*(2), 96-103.

Cruz, J. M., Boidi, M. F., & Queirolo, R. (2018). The status of support for cannabis regulation in Uruguay 4 years after reform: Evidence from public opinion surveys. *Drug and Alcohol Review, 37*, S429-S434.

Cunningham, J. A. (2020). Beliefs about cannabis at the time of legalization in Canada: Results from a general population survey. *Harm Reduction Journal*, *17*(1), 1-4.

Decorte, T., Lenton, S., & Wilkins, C. (Eds.). (2020). *Legalizing cannabis: Experiences, lessons and scenarios.* Routledge.

Di Forti, M., Marconi, A., Carra, E., Fraietta, S., Trotta, A., Bonomo, M., ... & Murray, R. M. (2015). Proportion of patients in south London with first-episode psychosis attributable to use of high potency cannabis: A case-control study. *The Lancet Psychiatry*, *2*(3), 233-238.

Earle, A. M., Napper, L. E., LaBrie, J. W., Brooks-Russell, A., Smith, D. J., & de Rutte, J. (2020). Examining interactions within the theory of planned behavior in the prediction of intentions to engage in cannabis-related driving behaviors. *Journal of American College Health*, *68*(4), 374-380.

Ellis, J. D., & Resko, S. M. (2022). *Attitudes and cannabis legalization. In Handbook of substance misuse and addictions: From biology to public health* (1-15). Cham: Springer International Publishing.

ElSohly, M. A., Mehmedic, Z., Foster, S., Gon, C., Chandra, S., & Church, J. C. (2016). Changes in cannabis potency over the last 2 decades (1995–2014): Analysis of current data in the United States. *Biological Psychiatry*, *79*(7), 613-619.

Elton-Marshall, T., Wells, S., Jankowicz, D., Nigatu, Y. T., Wickens, C. M., Rehm, J., & Hamilton, H. A. (2021). Multiple covid-19 risk factors increase the likelihood of experiencing anxiety symptoms in Canada. *The Canadian Journal of Psychiatry, 66*(1), 56-58.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175-191.

Fergusson, D. M., Boden, J. M., & Horwood, L. J. (2006). Cannabis use and other illicit drug use: testing the cannabis gateway hypothesis. *Addiction, 101*(4), 556-569.

Fischer, B., Imtiaz, S., Rudzinski, K., & Rehm, J. (2016). Crude estimates of cannabis-attributable mortality and morbidity in Canada–implications for public health focused intervention priorities. *Journal of Public Health, 38*(1), 183-188.

Fischer, B., Jeffries, V., Hall, W., Room, R., Goldner, E., & Rehm, J. (2011). Lower risk cannabis use guidelines for Canada (lrcug): A narrative review of evidence and recommendations. *Canadian Journal of Public Health, 102*(5), 324-327.

Fischer, B., Lee, A., O'Keefe-Markman, C., & Hall, W. (2020). Initial indicators of the public health impacts of non-medical cannabis legalization in Canada. *EClinicalMedicine, 20*.

Fischer, B., Lee, A., Robinson, T., & Hall, W. (2021). An overview of select cannabis use and supply indicators pre-and post-legalization in Canada. *Substance Abuse Treatment, Prevention, and Policy, 16*(1), 1-7.

Fischer, B., Robinson, T., Bullen, C., Curran, V., Jutras-Aswad, D., Medina-Mora, M. E., ... & Hall, W. (2021). Lower risk cannabis use guidelines (lrcug) for reducing health harms

from non-medical cannabis use: A comprehensive evidence and recommendations update. *International Journal of Drug Policy*, 103381.

Fischer, B., Russell, C., Rehm, J., & Leece, P. (2019). Assessing the public health impact of cannabis legalization in Canada: Core outcome indicators towards an 'index' for monitoring and evaluation. *Journal of Public Health, 41*(2), 412-421.

Fischer, B., Russell, C., Sabioni, P., Van Den Brink, W., Le Foll, B., Hall, W., ... & Room, R. (2017). Lower-risk cannabis use guidelines: A comprehensive update of evidence and recommendations. *American Journal of Public Health, 107*(8), e1-e12.

Forum Poll. (2015). *Marijuana Legalization, Regulation and Taxation, November 2015.* Forum Research.

Gagnon, F., Huynh, C., Kilborn, M., Fry, M., Vallée, R., & Janezic, I. (2022). Municipal regulation of cannabis and public health in Canada: A comparison of Alberta, Ontario, and Québec. *Behavioral Sciences & the Law, 6*(1).

Goodman, S., & Hammond, D. (2022). Perceptions of the health risks of cannabis: Estimates from national surveys in Canada and the United States, 2018–2019. *Health Education Research, 37*(2), 61-78.

Goodman, S., Fischer, B., & Hammond, D. (2020). Lower-risk cannabis use guidelines: Adherence in Canada and the US. *American Journal of Preventive Medicine, 59*(6), e211-e220.

Goodman, S., Leos-Toro, C., & Hammond, D. (2020). Risk perceptions of cannabis-vs. alcohol-impaired driving among Canadian young people. *Drugs: Education, Prevention and Policy, 27*(3), 205-212.

Greer, A., Sorge, J., Selfridge, M., Benoit, C., Jansson, M., & Macdonald, S. (2020). Police discretion to charge young people who use drugs prior to cannabis legalization in British Columbia, Canada: A brief report of quantitative findings. *Drugs: Education, Prevention and Policy, 27*(6), 488-493.

Hall, W., & Degenhardt, L. (2009). Adverse health effects of non-medical cannabis use. *The Lancet, 374*(9698), 1383-1391.

Hall, W., Leung, J., & Carlini, B. H. (2023). How should policymakers regulate the tetrahydrocannabinol content of cannabis products in a legal market?. *Addiction, 118*(6), 998-1003.

Hall, W., & Lynskey, M. (2020). Assessing the public health impacts of legalizing recreational cannabis use: The US experience. *World Psychiatry, 19*(2), 179-186.

Hall, W., Stjepanović, D., Dawson, D., & Leung, J. (2023). The implementation and public health impacts of cannabis legalization in Canada: A systematic review. *Addiction, 118*(11), 2062-2072.

Hall, W., & Weier, M. (2015). Assessing the public health impacts of legalizing recreational cannabis use in the USA. *Clinical Pharmacology & Therapeutics, 97*(6), 607-615.

Hallett, A., & Chen, S. P. (2022). Perceptions and attitudes of university and college students towards cannabis use. *International Journal of Mental Health and Addiction,* 1-20.

Hammond, D., & Goodman, S. (2022). Knowledge of tetrahydrocannabinol and cannabidiol levels among cannabis consumers in the United States and Canada. *Cannabis and Cannabinoid Research, 7*(3), 345-354.

Hammond, D., Goodman, S., Wadsworth, E., Rynard, V., Boudreau, C., & Hall, W. (2020). Evaluating the impacts of cannabis legalization: The international cannabis policy study. *International Journal of Drug Policy, 77*, 102698.

Hanson, V. J. (2020). *Cannabis policy reform: Jamaica's experience. Legalizing Cannabis*. Routledge.

Hartman, R. L., & Huestis, M. A. (2013). Cannabis effects on driving skills. *Clinical Chemistry, 59*(3), 478-492.

Hashibe, M., Morgenstern, H., Cui, Y., Tashkin, D. P., Zhang, Z. F., Cozen, W., ... & Greenland, S. (2006). Marijuana use and the risk of lung and upper aerodigestive tract cancers: Results of a population-based case-control study. *Cancer Epidemiology Biomarkers & Prevention*, *15*(10), 1829-1834.

Hasin, D. S., Saha, T. D., Kerridge, B. T., Goldstein, R. B., Chou, S. P., Zhang, H., ... & Grant, B. F. (2015). Prevalence of marijuana use disorders in the United States between 2001-2002 and 2012-2013. *JAMA Psychiatry*, *72*(12), 1235-1242.

Hasin, D. S., Sarvet, A. L., Cerdá, M., Keyes, K. M., Stohl, M., Galea, S., & Wall, M. M. (2017). US adult illicit cannabis use, cannabis use disorder, and medical marijuana laws: 1991-1992 to 2012-2013. *JAMA psychiatry*, *74*(6), 579-588.

Hasin, D., & Walsh, C. (2021). Trends over time in adult cannabis use: A review of recent findings. *Current Opinion in Psychology*, *38*, 80-85.

Health Canada. (2019). Canadian alcohol and drugs survey (cads): Summary of results for 2019. *Canada*. https://www.canada.ca/en/health-canada/services/canadian-alcohol-drugs-survey/2019-summary.html. Retrieved on: June 20, 2023.

Health Canada. (2022). Canadian cannabis survey (ccs) – 2022 summary. *Canada.* https://www.canada.ca/en/health-canada/services/drugs-medication/cannabis/research-data/canadian-cannabis-survey-2022-summary.html#s5. Retrieved on: June 20, 2023.

Health Canada. (2019). Canadian student tobacco alcohol and drugs survey (cstads): Summary of results for 2018-2019. *Canada.* https://www.canada.ca/en/health-canada/services/canadian-student-tobacco-alcohol-drugs-survey/2018-2019-summary.html. Retrieved on: June 20, 2023.

Hellemans, K. G., Wilcox, J., Nino, J. N., Young, M., & McQuaid, R. J. (2019). Cannabis use, anxiety, and perceptions of risk among Canadian undergraduates: The moderating role of gender. *Canadian Journal of Addiction, 10*(3), 22-29.

Herchenroeder, L., Mezquita, L., Bravo, A. J., Pilatti, A., Prince, M. A., & Study Team, C. C. A. (2022). A cross-national examination of cannabis protective behavioral strategies' role in the relationship between big five personality traits and cannabis outcomes. *The American Journal of Drug and Alcohol Abuse*, *48*(1), 27-37.

Hinkin, T. R. (1998). A brief tutorial on the development of measures for use in survey questionnaires. *Organizational Research Methods*, *1*(1), 104-121.

Holmes, E. A., O'Connor, R. C., Perry, V. H., Tracey, I., Wessely, S., Arseneault, L., ... & Bullmore, E. (2020). Multidisciplinary research priorities for the Covid-19 pandemic: A call for action for mental health science. *The Lancet Psychiatry, 7*(6), 547-560.

House of Commons of Canada. (2017). *Bill C-45: An Act respecting cannabis and to amend the Controlled Drugs and Substances Act, the Criminal Code and other Acts (Cannabis Act).*

Hughes, B., Quigley, E., Ballotta, D., & Griffiths, P. (2017). European observations on cannabis legalization. *Addiction, 112*(7), 1136-1137.

Huỳnh, C., Beaulieu-Thibodeau, A., Fallu, J. S., Bergeron, J., Flores-Aranda, J., Jacques, A., & Brochu, S. (2022). Risk factors associated with driving after cannabis use among Canadian young adults. *Journal of Drug Issues, 52*(2), 144-167.

Imtiaz, S., Wells, S., Rehm, J., Hamilton, H. A., Nigatu, Y. T., Wickens, C. M., ... & Elton-Marshall, T. (2021). Cannabis use during the Covid-19 pandemic in Canada: A repeated cross-sectional study. *Journal of Addiction Medicine, 15*(6), 484.

Imtiaz, S., Wells, S., Rehm, J., Wickens, C. M., Hamilton, H., Nigatu, Y. T., ... & Elton-Marshall, T. (2022). Daily cannabis use during the novel coronavirus disease (Covid-19) pandemic in Canada: A repeated cross-sectional study from May 2020 to December 2020. *Substance Abuse Treatment, Prevention, and Policy, 17*(1), 1-8.

Iseger, T. A., & Bossong, M. G. (2015). A systematic review of the antipsychotic properties of cannabidiol in humans. *Schizophrenia Research, 162(*1-3), 153-161.

Jackson, J., Bradford, B., Giacomantonio, C., & Mugford, R. (2023). Developing core national indicators of public attitudes towards the police in Canada. *Policing and Society, 33*(3), 276-295.

Jacobus, J., & F Tapert, S. (2014). Effects of cannabis on the adolescent brain. *Current Pharmaceutical Design, 20*(13), 2186-2193.

Khalid, B., Rajae, B., Hicham, F., & Herrak, L. (2014). Cannabis smoking and risk of lung cancer: A systematic review and meta-analysis. *Integrative Journal of Medical Sciences, 1*(2), 3-9.

Kim, C., Chum, A., Nielsen, A., Allin, S., Penney, T., Rittenbach, K., ... & O'Campo, P. (2022). Associations between recreational cannabis legalization and cannabis-related emergency

department visits by age, gender, and geographic status in Ontario, Canada: An interrupted time series study. *MedRxiv, 30.*

Kolar, K., Erickson, P., Hathaway, A., & Osborne, G. (2018). Differentiating the drug normalization framework: A quantitative assessment of cannabis use patterns, accessibility, and acceptability attitudes among university undergraduates. *Substance Use & Misuse, 53*(14), 2339-2349.

Lake, S., Kerr, T., Werb, D., Haines-Saah, R., Fischer, B., Thomas, G., ... & Milloy, M. J. (2019). Guidelines for public health and safety metrics to evaluate the potential harms and benefits of cannabis regulation in Canada. *Drug and Alcohol Review, 38*(6), 606-621.

Lazor, T., Blondal, E., Scheim, A., Cubillos, P., Werb, D., Milloy, M. J., ... & Rueda, S. (2022). Measurement of public health impacts of cannabis legalization in Canada to reflect policy maker priorities: A rapid scoping review of instruments and content domains. *Drug and Alcohol Dependence,* 109463.

Lee, C. R., Lee, A., Goodman, S., Hammond, D., & Fischer, B. (2020). The lower-risk Cannabis use guidelines'(LRCUG) recommendations: How are Canadian cannabis users complying? *Preventive Medicine Reports, 20*, 101187.

Lensch, T., Sloan, K., Ausmus, J., Pearson, J. L., Clements-Nolle, K., Goodman, S., & Hammond, D. (2020). Cannabis use and driving under the influence: Behaviors and attitudes by state-level legal sale of recreational cannabis. *Preventive Medicine Reports, 141,* 106320.

Leos-Toro, C., Fong, G. T., Meyer, S. B., & Hammond, D. (2020). Cannabis health knowledge and risk perceptions among Canadian youth and young adults. *Harm Reduction Journal, 17*(1), 1-13.

Leos-Toro, C., Fong, G. T., Meyer, S. B., & Hammond, D. (2020). Cannabis labelling and consumer understanding of THC levels and serving sizes. *Drug and Alcohol Dependence, 208*, 107843.

Leung, J., Chiu, C. Y. V., Stjepanović, D., & Hall, W. (2018). Has the legalisation of medical and recreational cannabis use in the USA affected the prevalence of cannabis use and cannabis use disorders?. *Current Addiction Reports, 5*(4), 403-417.

Livingston, M. D., Barnett, T. E., Delcher, C., & Wagenaar, A. C. (2017). Recreational cannabis legalization and opioid-related deaths in Colorado, 2000–2015. *American Journal of Public Health, 107*(11), 1827-1829.

Lorenzetti, V., Solowij, N., Whittle, S., Fornito, A., Lubman, D. I., Pantelis, C., & Yücel, M. (2015). Gross morphological brain changes with chronic, heavy cannabis use. *The British Journal of Psychiatry, 206*(1), 77-78.

MacKay, R., Phillips, K., & Tiedemann, M. (2017). *Legislative summary of Bill C-45: An Act respecting cannabis and to amend the Controlled Drugs and Substances Act, the Criminal Code and other Acts.* Legal and Social Affairs Division, Parliamentary Information and Research Service.

MacQuarrie, A. L., & Brunelle, C. (2022). Emerging attitudes regarding decriminalization: Predictors of pro-drug decriminalization attitudes in Canada. *Journal of Drug Issues*, *52*(1), 114-127.

Mahamad, S., Wadsworth, E., Rynard, V., Goodman, S., & Hammond, D. (2020). Availability, retail price and potency of legal and illegal cannabis in Canada after recreational cannabis legalisation. *Drug and Alcohol Review, 39*(4), 337-346.

Malhotra, N., Starkey, N. J., & Charlton, S. G. (2017). Driving under the influence of drugs: Perceptions and attitudes of New Zealand drivers. *Accident Analysis & Prevention, 106*, 44-52.

Malmberg, M., Overbeek, G., Vermulst, A. A., Monshouwer, K., Vollebergh, W. A., & Engels, R. C. (2012). The theory of planned behavior: Precursors of marijuana use in early adolescence? *Drug and Alcohol Dependence, 123*(1-3), 22-28.

Marconi, A., Di Forti, M., Lewis, C. M., Murray, R. M., & Vassos, E. (2016). Meta-analysis of the association between the level of cannabis use and risk of psychosis. *Schizophrenia Bulletin, 42*(5), 1262-1269.

Maxwell, J. C., & Mendelson, B. (2016). What do we know about the impact of the laws related to marijuana? *Journal of Addiction Medicine, 10*(1), 3.

McDonald, A. J., Hamilton, H. A., Wickens, C. M., Watson, T. M., Elton-Marshall, T., Wardell, J. D., ... & Mann, R. E. (2021). Driving under the influence of cannabis risk perceptions and behaviour: A population-based study in Ontario, Canada. *Preventive Medicine, 153*, 106793.

Moreau, G. (2019). Police-reported crime statistics in Canada, 2018. *Juristat: Canadian Centre for Justice Statistics*, 1-67.

Myran, D. T., Cantor, N., Finkelstein, Y., Pugliese, M., Guttmann, A., Jesseman, R., & Tanuseputro, P. (2022). Unintentional pediatric cannabis exposures after legalization of recreational cannabis in Canada. *JAMA network open, 5*(1), e2142521-e2142521.

Najafizada, M., Rahman, A., Donnan, J., Dong, Z., & Bishop, L. (2022). Analyzing sentiments and themes on cannabis in Canada using 2018 to 2020 twitter data. *Journal of Cannabis Research, 4*(1), 1-14.

Nkansah-Amankra, S., & Minelli, M. (2016). "Gateway hypothesis" and early drug use: additional findings from tracking a population-based sample of adolescents to adulthood. *Preventive Medicine Reports, 4*, 134-141.

O'Keefe, D. F., Kelloway, E. K., & Francis, R. (2012). Introducing the ocean. 20: A 20-Item five-factor personality measure based on the trait self-descriptive inventory. *Military Psychology, 24*(5), 433.

Olfson, M., Wall, M. M., Liu, S. M., & Blanco, C. (2018). Cannabis use and risk of prescription opioid use disorder in the United States. *American Journal of Psychiatry*, *175*(1), 47-53.

Pacheco, J. P. G., & Humes, E. D. C. (2020). Personality traits, alcohol and cannabis use among medical students. *Brazilian Journal of Psychiatry, 42*, 121-121.

Pardal, M., Queirolo, R., Álvarez, E., & Repetto, L. (2019). Uruguayan cannabis social clubs: from activism to dispensaries? *International Journal of Drug Policy*, *73*, 49-57.

Pardo, B., 2014. Cannabis policy reforms in the Americas: A comparative analysis of Colorado, Washington, and Uruguay. *International Journal of Drug Policy*, *25*(4), 727–735.

Perreault, S. (2016). Impaired driving in Canada, 2015. *Juristat: Canadian Centre for Justice Statistics*, 1.

Pham, T. T., Williams, J. V., Bulloch, A. G., Lukmanji, A., Dores, A. K., Isherwood, L. J., ... & Patten, S. B. (2022). Patterns of cannabis use before and after legalization in Canada. *Canadian Journal of Addiction, 13*(1), 27-35.

Pilin, M. A., Robinson, J. M., Young, K., & Krank, M. D. (2022). Cognitions mediate the influence of personality on adolescent cannabis use initiation. *Addictive Behaviors Reports, 15*, 100425.

Queirolo, R. (2020). *Uruguay: The first country to legalize cannabis. Legalizing Cannabis.* Routledge.

Raber, J. C., Elzinga, S., & Kaplan, C. (2015). Understanding dabs: Contamination concerns of cannabis concentrates and cannabinoid transfer during the act of dabbing. *The Journal of Toxicological Sciences, 40*(6), 797-803.

Ramaekers, J. G., Mason, N. L., Kloft, L., & Theunissen, E. L. (2021). The why behind the high: Determinants of neurocognition during acute cannabis exposure. *Nature Reviews Neuroscience, 22*(7), 439-454.

Rogeberg, O., & Elvik, R. (2016). The effects of cannabis intoxication on motor vehicle collision revisited and revised. *Addiction, 111*(8), 1348-1359.

Rotermann, M. (2019). Analysis of trends in the prevalence of cannabis use and related metrics in Canada. *Health Reports, 30*(6), 3-13.

Rotermann, M. (2020). Canadians who report lower self-perceived mental health during the COVID-19 pandemic more likely to report increased use of cannabis, alcohol and tobacco. *Health Reports, 31*(2), 5-10.

Rotermann, M. (2020). What has changed since cannabis was legalized. *Health Reports, 31*(2), 11-20.

Rotermann, M. (2021). Looking back from 2020, how cannabis use and related behaviours changed in Canada. *Health Reports, 32*(4), 3-14.

Rotermann, M., & Macdonald, R. (2018). Analysis of trends in the prevalence of cannabis use in Canada, 1985 to 2015. *Health Reports*, *29*(2), 10-20.

Russell, C., Rueda, S., Room, R., Tyndall, M., & Fischer, B. (2018). Routes of administration for cannabis use–basic prevalence and related health outcomes: A scoping review and synthesis. *International Journal of Drug Policy*, *52*, 87-96.

Sandhu, H. S., Anderson, L. N., & Busse, J. W. (2019). Characteristics of Canadians likely to try or increase cannabis use following legalization for nonmedical purposes: a cross-sectional study. *Canadian Medical Association Open Access Journal*, *7*(2), E399-E404.

Schauer, G. L., Njai, R., & Grant-Lenzy, A. M. (2020). Modes of marijuana use–smoking, vaping, eating, and dabbing: Results from the 2016 brfss in 12 states. *Drug and Alcohol Dependence*, *209*, 107900.

Shephard, A., Dölek, Ş., & Barrett, S. P. (2023). Investigating predictors of problematic alcohol, cannabis, and nicotine use among legal users of all three substances. *Frontiers in Psychiatry*, *14*, 1110415.

Schluter, M. G., & Hodgins, D. C. (2022). Measuring recent cannabis use across modes of delivery: Development and validation of the cannabis engagement assessment. *Addictive Behaviors Reports*, *15*, 100413.

Singh, T., Kennedy, S. M., Sharapova, S. S., Schauer, G. L., & V. Rolle, I. (2016). Modes of ever marijuana use among adult tobacco users and non-tobacco users—styles 2014. *Journal of Substance Use*, *21*(6), 631-635.

Solomon, R., Chamberlain, E., & Vandenberghe, M. (2018). Canada's new cannabis-related driving legislation: The elusive quest for an effective deterrent. *Canadian Criminal Law Review*, *23*(3), 265-290.

Statistics Canada. (2020). National cannabis survey (ncs) - 2020. Ottawa, ON: Statistics Canada. Government of Canada. *Statcan*. https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5262. Retrieved on: June 20, 2023.

Steinemann, S., Galanis, D., Nguyen, T., & Biffl, W. (2018). Motor vehicle crash fatalities and undercompensated care associated with legalization of marijuana. *Journal of Trauma and Acute Care Surgery, 85*(3), 566-571.

Stolzenberg, L., D'Alessio, S. J., & Dariano, D. (2016). The effect of medical cannabis laws on juvenile cannabis use. *International Journal of Drug Policy, 27*, 82-88.

Terry, P., & Wright, K. A. (2005). Self-reported driving behaviour and attitudes towards driving under the influence of cannabis among three different user groups in England. *Addictive Behaviors, 30*(3), 619-626.

United Nations Office on Drugs and Crime. (2020). *World Drug Report 2020: Drug use and health consequences.* United Nations.

Vaillancourt, L., Viel, E., Dombrowski, C., Desharnais, B., & Mireault, P. (2021). Drugs and driving prior to cannabis legalization: A 5-year review from decp (dre) cases in the province of Quebec, Canada. *Accident Analysis & Prevention, 149*, 105832.

Varin, M., MacEachern, K. H., Hussain, N., & Baker, M. M. (2021). At-a-glance-measuring self-reported change in alcohol and cannabis consumption during the second wave of the Covid-19 pandemic in Canada. *Health Promotion and Chronic Disease Prevention in Canada: Research, Policy and Practice, 41*(11), 325.

Volkow, N. D., Baler, R. D., Compton, W. M., & Weiss, S. R. (2014). Adverse health effects of marijuana use. *New England Journal of Medicine, 370*(23), 2219-2227.

Wadsworth, E., Craft, S., Calder, R., & Hammond, D. (2022). Prevalence and use of cannabis products and routes of administration among youth and young adults in Canada and the United States: A systematic review. *Addictive Behaviors,* 107258.

Wadsworth, E., Driezen, P., Pacula, R. L., & Hammond, D. (2022). Cannabis flower prices and transitions to legal sources after legalization in Canada, 2019–2020. *Drug and Alcohol Dependence, 231,* 109262.

Wadsworth, E., & Hammond, D. (2019). International differences in patterns of cannabis use among youth: prevalence, perceptions of harm, and driving under the influence in Canada, England & United States. *Addictive Behaviors, 90,* 171-175.

Wallingford, S., Konefal, S., Young, M. M., & Student Drug Use Surveys Working Group. (2019). *Cannabis use, harms and perceived risks among Canadian students. Ottawa, Ontario, Canada.* Canadian Centre on Substance use and Addiction.

Watson, T. M., Hyshka, E., Bonato, S., & Rueda, S. (2019). Early-stage cannabis regulatory policy planning across Canada's four largest provinces: A descriptive overview. *Substance Use & Misuse, 54*(10), 1691-1704.

Wettlaufer, A., Florica, R. O., Asbridge, M., Beirness, D., Brubacher, J., Callaghan, R., ... & Rehm, J. (2017). Estimating the harms and costs of cannabis-attributable collisions in the Canadian provinces. *Drug and Alcohol Dependence, 173,* 185-190.

Wickens, C. M., Watson, T. M., Mann, R. E., & Brands, B. (2019). Exploring perceptions among people who drive after cannabis use: Collision risk, comparative optimism and normative influence. *Drug and Alcohol Review, 38*(4), 443-451.

Wickens, C. M., Mann, R. E., Brands, B., Stoduto, G., Matheson, J., Sayer, G., ... & Le Foll, B. (2021). Influence of personality on acute smoked cannabis effects on simulated driving. *Experimental and Clinical Psychopharmacology, 8.*

Williams, A. R. (2020). Cannabis as a gateway drug for opioid use disorder. *The Journal of Law, Medicine & Ethics*, *48*(2), 268-274.

Wilson, J., Mills, K., Freeman, T. P., Sunderland, M., Visontay, R., & Marel, C. (2022). Weeding out the truth: A systematic review and meta-analysis on the transition from cannabis use to opioid use and opioid use disorders, abuse, or dependence. *Addiction*, *117*(2), 284-298.

Windle, S. B., Sequeira, C., Filion, K. B., Thombs, B. D., Reynier, P., Grad, R., ... & Eisenberg, M. J. (2021). Impaired driving and legalization of recreational cannabis. *Canadian Medical Association Journal*, *193*(14), E481-E485.

Windle, S. B., Socha, P., Nazif-Munoz, J. I., Harper, S., & Nandi, A. (2022). The Impact of Cannabis Decriminalization and Legalization on Road Safety Outcomes: A Systematic Review. *American Journal of Preventive Medicine*, *63*(6), 1037-1052.

Windle, S. B., Wade, K., Filion, K. B., Kimmelman, J., Thombs, B. D., & Eisenberg, M. J. (2019). Potential harms from legalization of recreational cannabis use in Canada. *Canadian Journal of Public Health, 110*(2), 222-226.

Winstock, A. R., Lynskey, M. T., Maier, L. J., Ferris, J. A., & Davies, E. L. (2021). Perceptions of cannabis health information labels among people who use cannabis in the US and Canada. *International Journal of Drug Policy, 91*, 102789.

Yousufzai, S. J., Cole, A. G., Nonoyama, M., & Barakat, C. (2022). Changes in cannabis consumption among emerging adults in relation to policy and public health developments. *Substance Use & Misuse, 57*(5), 730-741.

Zhu, N., Zhang, D., Wang, W., Li, X., Yang, B., Song, J., ... & Tan, W. (2020). A novel coronavirus from patients with pneumonia in China, 2019. *New England Journal of Medicine, 382*(8), 727–733.

Appendix A

Survey - Cannabis Use Behaviours

Prevalence, Frequency, Modes, Mixing, & Covid-19:

1. Have you ever used cannabis? ( ) Yes ( ) No

2. If yes, how recently? ( ) Over a year ago ( ) Within the past year ( ) Within the past month ( ) Within the past week ( ) Today

3. How often do you use cannabis? ( ) Once a year ( ) Twice a year ( ) Monthly ( ) Weekly ( ) More than once a week ( ) Daily

4. How long have you been using cannabis, at this rate? ( ) Over five years ( ) Three to five years ( ) Two years ( ) One year ( ) Half a year ( ) One to five months ( ) Less than a month ( ) Less than a week

5. Are you a medical cannabis user? ( ) Yes ( ) No

6. Are you a recreational cannabis user? ( ) Yes ( ) No

7. How much cannabis do you personally ingest during your average usage? ( ) Less than 0.3 grams (less than one joint) ( ) 0.3 grams (equivalent to one joint) ( ) 0.6 grams (two joints) ( ) 0.9 grams (three joints) ( ) More than 0.9 grams (more than three joints)

8. How old were you when you first used cannabis? [ ]

9. How do you most typically use cannabis? Check all that apply: [ ] Smoking (i.e., bong, joint, spliff, pipe) [ ] Vaporizing (i.e., handheld vaporizer pens or larger vaporizer devices) [ ] Consuming edibles (i.e., any cannabis-infused food product) [ ] THC or CBD pills [ ] THC extract/concentrate (i.e., dabbing, cannabis wax, hash)

10. How often do you use cannabis in this way? ( ) Once a year ( ) Twice a year ( ) Monthly ( ) Weekly ( ) More than once a week ( ) Daily

11. What is the second most typical way you use cannabis? ( ) Smoking (i.e., bong, joint, spliff, pipe) ( ) Vaporizing (both handheld pens and larger devices) ( ) Consuming edibles (i.e., any cannabis-infused food product) ( ) THC or CBD pills ( ) THC extract/concentrate (i.e., dabbing, cannabis wax, hash)

12. How often do you use cannabis in this way? (i.e., your second most typical way of using cannabis) ( ) Once a year ( ) Twice a year ( ) Monthly ( ) Weekly ( ) More than once a week ( ) Daily ( )

13. Do you mix cannabis with tobacco? ( ) Yes ( ) No

14. How often do you mix cannabis with tobacco? ( ) Once a year ( ) Twice a year ( ) Monthly ( ) Weekly ( ) More than once a week ( ) Daily

15. Do you use cannabis and alcohol together? ( ) Yes ( ) No

16. How often do you mix cannabis with alcohol? ( ) Once a year ( ) Twice a year ( ) Monthly ( ) Weekly ( ) More than once a week ( ) Daily

17. Did your cannabis use change during Covid-19? ( ) Yes ( ) No ( ) Unsure

18. If yes, how did your cannabis use change during Covid-19? ( ) Increased ( ) Decreased

19. If yes, how much did you use prior to Covid-19? ( ) Once a year ( ) Twice a year ( ) Monthly ( ) Weekly ( ) More than once a week ( ) Daily ( )

Product Preferences, Prices, and Amounts Purchased:

1. Do you only use CBD dominant cannabis products? (i.e., cannabis products that do not contain THC) ( ) Yes ( ) Sometimes ( ) No

2. Do you know how much THC is in the cannabis that you use? (i.e., the percentage of THC - the psychoactive chemical in cannabis) ( ) Yes ( ) Sometimes ( ) No

3. Do you have a preference for a certain type or strain of cannabis? ( ) Yes ( ) Sometimes ( ) No

4. If yes, please explain your preference for a certain type or strain of cannabis: [ ]

5. Were you aware of the Provincial Government's online survey about cannabis legalization? ( ) Yes ( ) No

6. Did you complete the Provincial Government's online survey about cannabis legalization? ( ) Yes ( ) No

7. If yes, how many times did you complete the Provincial Government's online survey about cannabis legalization? [ ]

8. How much do you typically pay for cannabis? ( ) Less than $5/gram of cannabis ( ) $5/gram ( ) $6/gram ( ) $7/gram ( ) $8/gram ( ) $9/gram ( ) $10/gram ( ) $11/gram ( ) $12/gram ( ) $13/gram ( ) $14/gram ( ) $15/gram ( ) $16/gram ( ) $17/gram ( ) $18/gram ( ) $19/gram ( ) $20/gram ( ) Over $20/gram of cannabis

9. How much cannabis do you typically purchase at one time? (in terms of grams: 1 gram = 3 joints) ( ) Less than 1 gram ( ) 1 - 5 gram(s) ( ) 6 - 10 grams ( ) 11 - 15 grams ( ) 16 - 20 grams ( ) 21 - 25 grams ( ) 26 - 30 grams ( ) 31 - 35 grams ( ) 36 or more grams

Appendix B

Survey - Impaired Driving Behaviours

Prevalence, Frequency, and Modes:

1. Have you ever driven under the influence of cannabis? ( ) Yes ( ) No

2. If yes, how recently? ( ) Over a year ago ( ) Within the last year ( ) Within the last month ( ) Within the last week ( ) Within the last 24 hours

3. If yes, how often? ( ) Less than once a year ( ) Once a year ( ) Once a month ( ) Once a week ( ) Once a day

4. If yes, how soon did you drive after using cannabis? ( ) Within minutes ( ) 10-30 minutes ( ) 30-60 minutes ( ) 1-1.5 hours ( ) 1.5-2 hours ( ) 2-2.5 hours ( ) 2.5-3 hours ( ) 3-3.5 hours ( ) 3.5-4 hours ( ) 4-5 hours ( ) More than 5 hours

5. In what form did you ingest cannabis before driving? Choose all that apply: ( ) Smoking ( ) Vaporizing ( ) Edibles/orally

6. Have you ever driven under the influence of alcohol? ( ) Yes ( ) No

7. If yes, how recently? ( ) Over a year ago ( ) Within the last year ( ) Within the last month ( ) Within the last week ( ) Within the last 24 hours

8. If yes, how often? ( ) Less than once a year ( ) Once a year ( ) Once a month ( ) Once a week ( ) Once a day

9. Have you ever driven while distracted? (e.g., used your phone) ( ) Yes ( ) No

10. If yes, how recently? ( ) Over a year ago ( ) Within the last year ( ) Within the last month ( ) Within the last week ( ) Within the last 24 hours

11. If yes, how often? ( ) Less than once a year ( ) Once a year ( ) Once a month ( ) Once a week ( ) Once a day

12. Have you ever driven while fatigued? (i.e., very tired) ( ) Yes ( ) No

13. If yes, how recently? ( ) Over a year ago ( ) Within the last year ( ) Within the last month ( ) Within the last week ( ) Within the last 24 hours

14. If yes, how often? ( ) Less than once a year ( ) Once a year ( ) Once a month ( ) Once a week ( ) Once a day

Motor Vehicle Accidents and Riding as a Passenger:

1. Have you been involved in a motor vehicle accident as a driver? ( ) Yes ( ) No

2. If yes, how recently? ( ) Over three years ago ( ) Over two years ago ( ) Over one year ago ( ) Within the last year ( ) Within the last six months ( )Within the last month

3. How many times have you been involved in a motor vehicle accident as a driver? [ ]

4. Were you ever under the influence of cannabis when involved (driving) in a motor vehicle accident? ( )Yes ( ) No

5. How many times were you under the influence of cannabis when involved (driving) in a motor vehicle accident? [ ]

6. Were you ever under the influence of alcohol when involved (driving) in a motor vehicle accident? ( ) Yes ( ) No

7. How many times were you under the influence of alcohol when involved (driving) in a motor vehicle accident? [ ]

8. Were you ever under the influence of both cannabis and alcohol when involved (driving) in a motor vehicle accident? ( ) Yes ( ) No

9. How many times were you under the influence of both alcohol and cannabis when involved (driving) in a motor vehicle accident? [ ]

10. Were you ever engaged in distracted driving when involved (driving) in a motor vehicle accident? ( ) Yes ( ) No

11. How many times were you engaged in distracted driving when involved (driving) in a motor vehicle accident? [ ]

12. Were you ever fatigued when involved (driving) in a motor vehicle accident? ( ) Yes ( ) No

13. How many times were you fatigued when involved (driving) in a motor vehicle accident? [ ]

14. How long have you been driving for? [ ]

15. Would you accept a ride from a driver who was under the influence of cannabis? ( ) Yes ( ) No

16. Would you accept a ride from a driver who was under the influence of alcohol? ( ) Yes ( ) No

17. Would you accept a ride from a driver who you knew was going to drive while distracted? ( ) Yes ( ) No

18. Would you accept a ride from a driver who was fatigued? (i.e., very tired) ( ) Yes ( ) No

19. Have you ever accepted a ride from a driver who was under the influence of cannabis? ( ) Yes ( ) No

20. Have you ever accepted a ride from a driver who was under the influence of alcohol? ( ) Yes ( ) No

21. Have you ever accepted a ride from a driver who you knew was going to drive while distracted? ( ) Yes ( ) No

22. Have you ever accepted a ride from a driver who was driving while fatigued? (i.e., very tired) ( ) Yes ( ) No

Appendix C

Survey - Cannabis Use Attitudes

Federal Legalization & Covid-19:

Please indicate **how much you agree** with each statement using the following 1-9 scale.

1 – Do not agree at all	2	3	4	5	6	7	8	9 – Comple -tely agree

1. Cannabis should be legal.
2. The Federal government is/was prepared for the legalization of cannabis.
3. The Federal government is doing/did a good job of preparing for the legalization of cannabis.
4. The Provincial government is/was prepared for the legalization of cannabis.
5. The Provincial government is doing/did a good job of preparing for the legalization of cannabis.
6. The government should be responsible for the retail of cannabis.
7. Licensed and private organizations should be responsible for the retail of cannabis.
8. The Halifax Regional Police are/were prepared for the legalization of cannabis.
9. The RCMP are/were prepared for the legalization of cannabis.
10. The Halifax Regional Police are doing/did a good job of preparing for the legalization of cannabis.
11. The RCMP are doing/did a good job of preparing for the legalization of cannabis.
12. The Halifax Regional Police are able to recognize if a driver is impaired from the use of cannabis.
13. The RCMP are able to recognize if a driver is impaired from the use of cannabis.

14. The Halifax Regional Police are/were ready to enforce new laws relating to drivers impaired from the use of cannabis.
15. The RCMP are/were ready to enforce new laws relating to drivers impaired from the use of cannabis.
16. The Halifax Regional Police understand the newly proposed legal limits of driving under the influence of cannabis.
17. The RCMP understand the newly proposed legal limits of driving under the influence of cannabis.
18. Cannabis is easy to obtain.
19. Cannabis will become/is easier to obtain once it becomes/became legalized.
20. Canadians should be able to grow cannabis in their residence.
21. Canadians should be able to grow cannabis outdoors on their property.
22. Cannabis should be available for purchase online and have home delivery service.
23. Legalization will help limit the illegal sale of cannabis.
24. Legalization will make it easier for youth to access cannabis.
25. Legalization will help make our roads safer from impaired drivers.
26. The Federal government should legalize recreational Cocaine use.
27. The Federal government should legalize recreational Psychedelic Mushroom use.
28. The Federal government should legalize recreational MDMA/Ecstasy use.
29. The Federal government should legalize recreational LSD/Acid use.
30. The Federal government should legalize recreational Ketamine use.
31. The Federal government should legalize recreational Heroin use.
32. The Federal government should legalize recreational DMT use.

33. Covid-19 negatively affected my mental health.

Health and Sources of Knowledge:

Please indicate **how much you agree** with each statement using the following 1-9 scale.

1 – Do not agree at all	2	3	4	5	6	7	8	9 – Comple -tely agree

1. Cannabis has medicinal benefits.
2. Cannabis can be addictive.
3. Using cannabis can be a risk to one's health.
4. Using cannabis is less risky to one's health than drinking alcohol.
5. Using cannabis is less risky to one's health than using tobacco.
6. Using cannabis is less risky to one's health than using other drugs.
7. I have learned about cannabis through formal education (e.g., high school, university).
8. I have learned about cannabis through use on television and in movies.
9. I have learned about cannabis through people I know who have used it.
10. I have learned about cannabis from government awareness campaigns.
11. I have learned about cannabis from my own personal use.
12. I have learned about cannabis from reading scientific studies.
13. I have learned about cannabis from news articles on the internet.
14. I have learned about cannabis from news articles shared on social media.
15. I have learned about cannabis from other sources.

Personal Problematic Use and Stigma:

Please indicate **how much you agree** with each statement using the following 1-9 scale.

1 –	2	3	4	5	6	7	8	9 – Comple

Do not agree at all								-tely agree

1. My cannabis use is problematic
2. My alcohol use is problematic
3. I am afraid to be stigmatized for my cannabis use
4. I am afraid to be stigmatized for my alcohol use
5. I am stigmatized for my cannabis use
6. I am stigmatized for my alcohol use
7. My cannabis use is a threat to my job prospects
8. My alcohol use is a threat to my job prospects

Appendix D

Survey - Impaired Driving Attitudes

Perceived Dangerousness:

Please indicate **how much you agree** with each statement using the following 1-9 scale.

1 – Do not agree at all	2	3	4	5	6	7	8	9 – Comple -tely agree

1. Driving under the influence of cannabis is dangerous
2. Driving under the influence of cannabis impairs your ability to drive
3. Driving under the influence of alcohol is dangerous
4. Driving under the influence of cannabis is less dangerous than driving under the influence of alcohol
5. Driving while fatigued is dangerous
6. Driving while distracted is dangerous
7. Texting and driving is dangerous
8. I am better at driving under the influence of cannabis than others
9. I am better at driving under the influence of alcohol than others
10. I am better at driving while distracted than others
11. I am better at driving while fatigued than others

Acceptability of Types:

1. Is it acceptable to drive under the influence of cannabis? ( ) Yes ( ) No

2. Is it acceptable for some people to drive while under the influence of cannabis, but not others? ( ) Yes ( ) No

3. If yes, please explain: [ ]

4. Is it acceptable to drive under the influence of alcohol? ( ) Yes ( ) No

5. Is it acceptable for some people to drive while under the influence of alcohol, but not others? ( ) Yes ( ) No

6. If yes, please explain: [ ]

7. Is it acceptable to drive while distracted? (e.g., being on your phone) ( ) Yes ( ) No

8. Is it acceptable for some people to drive while distracted, but not others? ( ) Yes ( ) No

9. If yes, please explain: [ ]

10. Is it acceptable to drive while fatigued? (i.e., very tired) ( ) Yes ( ) No

11. Is it acceptable for some people to drive while fatigued, but not others? ( ) Yes ( ) No

12. If yes, please explain: [ ]

New Legislation and Enforcement:

1. What should the legal limit be for using cannabis and driving? ( ) Zero tolerance for cannabis use and driving ( ) Less than 0.3 grams (less than once joint) ( ) 0.3 grams (equivalent to one joint) ( ) 0.6 grams (two joints) ( ) 0.9 grams (three joints) ( ) More than 0.9 grams (more than three joints)

2. Do you understand the proposed legal limits of driving under the influence of cannabis? *"Having at least 2 ng of THC per millilitre (ml) of blood within two hours of driving would be a criminal offence, with severity of the offence increasing with the amount of THC"* ( ) Yes ( ) Somewhat ( ) No

3. Please explain what the proposed legal limits mean, in your own words: [ ]

4. When driving under the influence of cannabis, do you feel at risk of being caught by the Police/RCMP? ( ) Yes ( ) No

5. How often can Police/RCMP detect if a driver is impaired from using cannabis? ( ) Always ( ) Most of the time ( ) About half the time ( ) Sometimes ( ) Never ( )

6. How often can Police/RCMP detect if a driver is impaired from alcohol? ( ) Always ( ) Most of the time ( ) About half the time ( ) Sometimes ( ) Never ( )

7. Do you understand the roadside screening procedures that police use to detect cannabis-impaired drivers? ( ) Yes ( ) No

8. Please explain your understanding of police roadside screening procedures to detect cannabis-impaired drivers: [ ]

Appendix E

Survey – Group and Individual Characteristics

Big 5 Personality (OCEAN-20):

1 - Extremely characteristic	2 - Quite Uncharacteristic	3 - Slightly Uncharacteristic	4 - Neither Characteristic nor Uncharacteristic	5 - Slightly Characteristic	6 - Quite Characteristic	7 - Extremely Characteristic

1. Silent
2. Neat
3. Sympathetic
4. Organized
5. Withdrawn
6. Kind
7. Quiet
8. I have thought a lot about the origins of the universe
9. I like to keep all my belongings near and organized
10. I often have headaches when things are not going well
11. I am always generous when it comes to helping others
12. Sometimes I get so upset, I feel sick to my stomach
13. I am highly interested in all fields of science
14. I like to have a place for everything and everything in its place
15. I am fascinated with the theory of evolution
16. When I am under great stress, I often feel like I am about to break down
17. I always treat other people with kindness
18. My feelings are easily hurt

19. I am a very shy person

20. I would enjoy being a theoretical scientist

Demographic Information:

1. What is your age? [ ]

2. What is your sex? ( ) Male ( ) Female ( ) If neither, please specify: [ ]

3. Please specify which race/ethnicity best describes you. ( ) Acadian ( ) Arab ( ) Black/African ( ) Caribbean ( ) Chinese ( ) East European ( ) Filipino ( ) First Nations/Native American ( ) French Canadian ( ) Jewish ( ) Japanese ( ) Korean ( ) Metis ( ) Middle Eastern ( ) South Asian ( ) West Asian ( ) West European ( ) White/Caucasian ( ) Unsure ( ) Other (Please specify): [ ]

4. What is the highest level of school you have completed or the highest degree you have received? ( ) Less than high school degree ( ) High school graduate (high school diploma or equivalent including GED) ( ) Some college but no degree ( ) College diploma or certificate ( ) Bachelor's degree in college (4-year) ( ) Master's degree ( ) Doctoral degree ( ) Professional degree (JD, MD)

5. Please indicate the answer that matches your yearly household income in the *previous year*. ( ) Less than $10,000 ( ) $10,000 to $19,999 ( ) $20,000 to $29,999 ( ) $30,000 to $39,999 ( ) $40,000 to $49,999 ( ) $50,000 to $59,999 ( ) $60,000 to $69,999 ( ) $70,000 to $79,999 ( ) $80,000 to $89,999 ( ) $90,000 to $99,999 ( ) $100,000 to $149,999 ( ) $150,000 or more

6. Please indicate the answer that matches your yearly family household income *growing up*. ( ) Less than $10,000 ( ) $10,000 to $19,999 ( ) $20,000 to $29,999 ( ) $30,000 to $39,999 ( ) $40,000 to $49,999 ( ) $50,000 to $59,999 ( ) $60,000 to $69,999 ( ) $70,000 to $79,999 ( ) $80,000 to $89,999 ( ) $90,000 to $99,999 ( ) $100,000 to $149,999 ( ) $150,000 or more

Appendix F:

Informed Consent & Debriefing Forms

Consent Form:

Cannabis Use and Attitudes throughout Federal Legalization and the Covid-19 Pandemic

SMU REB # 18-186

Matthew R. Labrecque and Dr. Marc Patry

Psychology Department

Saint Mary's University, 923 Robie Street, Halifax, NS B3H 3C3

INTRODUCTION:

My name is Matthew Labrecque and I am a Master of Science in Applied (Forensic) Psychology student. This research project is being conducted under the supervision of Dr. Marc Patry.

You are being invited to participate in our research study. Taking part in this study is voluntary and you are free to stop your participation at any time for any reason.

PURPOSE OF THIS RESEARCH:

The purpose of this study is to learn where Nova Scotians stand on issues related to drug-driving and the legalization of cannabis. We are also interested in how Nova Scotians use cannabis – looking at questions such as how often users use cannabis in general, as well as how often they use cannabis and drive. Given the legalization of cannabis, all levels of government must ensure that they are drafting legislation that addresses the concerns of Canadian citizens regarding the public health risks that come along with drug-driving. It is especially important to understand the public's current behaviours and views regarding drug-driving in relation to the unique concerns of their province or jurisdiction.

Our aim is to collect information on various issues such as: dangerousness of drug-driving, self-reported drug-driving, government preparedness for legalization, and police services in the context of drug-driving and drug law enforcement. Our research aims to inform Nova Scotia's response to cannabis legalization, specifically regarding the issue of cannabis-impaired drivers, as well as public health campaigns.

WHO IS ELIGIBLE TO TAKE PART? (OR WHO IS BEING INVITED TO PARTICIPATE?)

Who can?

Saint Mary's students who are registered in the SONA system are eligible to participate in our research.

Who can't?

There are no exclusion criteria for this study.

WHAT DOES PARTICIPATING MEAN? (OR WHAT WILL I HAVE TO DO?)

Where?

This research is to be completed online, individually.

What?

After you sign up for the study via the SONA system, you will view the informed consent form. If you should agree to the terms of the informed consent form and provide your consent, you will be linked to an online survey. You will then complete an online survey asking various questions about cannabis. The survey covers various topics related to cannabis and more, with some examples of survey items being: "How often do you use cannabis?", "Do you believe cannabis impairs your ability to drive?", as well as degree of agreement with "The Federal government is doing a good job of preparing for the legalization of cannabis". After completing the survey, you will view a debriefing form.

When/How long?

The survey should take you approximately 30 minutes to complete and can be done online, whenever you choose.

WHAT ARE THE POTENTIAL BENEFITS OF THIS RESEARCH?

Direct benefits to you from this research are the opportunity to potentially learn more about cannabis as well as providing an avenue for you to express your opinions about new laws and legislation. Benefits to society are that these data points will be used to inform and recommend evidence-based decisions made by the Federal and Provincial governments. The scientific literature will also benefit from this research, as there is a lack of research being done that investigates attitudes about legalization within Nova Scotia.

WHAT ARE THE POTENTIAL RISKS FOR PARTICIPANTS?

There is minimal risk in participating in this research. That is, by simply completing a brief online survey, you will not be at any higher risk for harm than you would be on any other day. However, some participants may feel uncomfortable revealing information about criminal behaviour – even though this information will remain completely confidential – this means that nobody except the researchers will ever see your responses. If you have sensitivities to certain sections of the protocol (specific questions, etc.) you may skip them. You should not fear any criminal consequences for revealing that you have used illegal drugs or done something else illegal.

WHAT WILL BE DONE WITH MY INFORMATION? (OR WHO WILL HAVE ACCESS TO IT?)

Types of Information:

Directly or indirectly identifying information will not be collected. All responses will be coded with an arbitrary numerical identifier, as well as analyzed and presented as group data. Demographical information being collected are: Race, gender ID, age, and household income.

Will the data be kept confidential?

Yes, only the primary investigator and supervisor will have access to the coded data responses. Confidentiality will be ensured by having all survey responses remain anonymous, as well as storing this data in password protected online folders and/or in a locked cabinet in a locked laboratory at Saint Mary's University.

How will data be kept secure? Digital data will be kept in on a password-protected computer that only the researchers will have access to. Only group data will be reported in published papers and presentations.

Dissemination of research results:

Once all the data are collected and analyzed for this study, I plan on sharing the information with the research community through seminars, conferences, presentations, journal articles, and policy recommendations. This information will be publicly available if this research is accepted by a research journal.

Dissemination of research results to participant:

You will be able to access the study results via email when it becomes available, if you provide their email address when asked on the debriefing form.

WHAT TYPE OF COMPENSATION IS AVAILABLE FOR PARTICIPATION?

You will receive a 0.5% credit for your 30 minutes of participation (0.25% credits per 15 minutes of online participation is standard).

HOW CAN I WITHDRAW FROM THIS STUDY?

You are free to withdraw from the research study at any time without penalty. To withdraw, you may simply exit the web browser. If you would like your data removed from the study, please contact the primary investigator.

HOW CAN I GET MORE INFORMATION? (OR HOW CAN I FIND OUT MORE ABOUT THIS STUDY?):

For more information, scholarly discussions about the research, issues regarding ethical matters, or reporting of adverse effects, please contact the primary investigator: Matthew Labrecque (contact info provided above). Participants can discuss the study with the primary investigator (and faculty supervisor, if applicable) at any time and the research team will answer questions and be available during the course of the study.

MENTAL HEALTH RESOURCE:

If you are experiencing any adverse effects from participation, please contact The Counselling Centre at Saint Mary's University: 902-420-5615, counselling@smu.ca, 4th Floor Student Centre.

Certification:

This research has been reviewed and approved by the Saint Mary's University Research Ethics Board. If you have any questions or concerns about ethical matters or would like to discuss your rights as a research participant, you may contact the Chair of the Research Ethics Board at ethics@smu.ca or 420-5728.

Cannabis Use and Attitudes throughout Federal Legalization and the Covid-19 Pandemic

Consent:

I understand what this study is about, appreciate the risks and benefits, and that by consenting I agree to take part in this research study and do not waive any rights to legal recourse in the event

of research-related harm.

I understand that my participation is voluntary and that I can end my participation at any time without penalty.

I have had adequate time to think about the research study and have had the opportunity to ask questions.

By clicking "I accept", I as a participant consent to taking part in this study. ( ) I accept ( ) I do not accept

Debriefing Form:

Cannabis Use and Attitudes throughout Federal Legalization and the Covid-19 Pandemic

SMU REB # 18-186

Matthew R. Labrecque and Dr. Marc Patry

Psychology Department

Saint Mary's University, 923 Robie Street, Halifax, NS B3H 3C3

Dear participant: I would like to thank you for your participation in this study.

As a reminder, the purpose of this study is to learn where Nova Scotians stand on issues related to drug-driving and the legalization of cannabis. We are also interested in how Nova Scotians use cannabis – looking at questions such as how often users use cannabis in general, as well as how often they use cannabis and drive. Given the legalization of cannabis, all levels of government must ensure that they are drafting legislation that addresses the concerns of Canadian citizens regarding the public health risks that come along with drug-driving. It is especially important to understand the public's current behaviours and views regarding drug-driving in relation to the unique concerns of their province or jurisdiction.

The data collected from the survey aims to inform Nova Scotia's response to cannabis legalization, specifically regarding the issue of cannabis-impaired drivers, as well as public health campaigns.

Please remember that any data pertaining to you as an individual participant will be kept confidential. Once all the data are collected and analyzed for this project, I plan on sharing this information with the scientific community through seminars, conferences, presentations, and journal articles. If you would like your data removed from the study, please contact the primary investigator.

If you are interested in receiving more information regarding the results of this study, or if you have any questions or concerns, please contact me at either the phone number or email address listed at the bottom/top of the page.

If you would like a summary of the results, please let me know by emailing me at the contact information provided above. When the study is completed, we will send it to you.

As with all Saint Mary's University projects involving human participants, this project was reviewed by the Saint Mary's University Research Ethics Board. Should you have any comments or concerns about ethical matters or would like to discuss your rights as a research participant, please contact the Chair of the Research Ethics Board at 902-420-5728 or ethics@smu.ca.

If you are experiencing any adverse effects from participation, please contact The Counselling Centre at Saint Mary's University: 902-420-5615, counselling@smu.ca, 4th Floor Student Centre.

Thank you for your participation. Matthew R. Labrecque, BA (Hons.), MSc Student | Forensic Psychology | Saint Mary's University | 923 Robie Street, Halifax, NS, B3H 3C3.