

**From reefer madness to regulation:
Analyzing Canada's strategies to evaluate the public
health impacts of recreational cannabis legalization**

**by
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Abstract

On October 17, 2018, cannabis became legal to possess and use for recreational purposes in Canada. Canada's approach to cannabis regulation was initially constructed as a deviancy issue, and is now being constructed as an issue central to public health. However, there is currently no consensus as to what specifically a public health approach to cannabis legalization entails. Literature from relevant jurisdictions with legal recreational cannabis has outlined some important public health metrics to consider with respect to cannabis legalization. The current study explores five of these public health metrics regarding cannabis legalization in Canada, in order to determine how well equipped Canada is to evaluate the public health impacts of cannabis legalization, and the current research strategies in place to evaluate this unprecedented policy change. Analyzing these strategies is important in order to determine whether recreational cannabis legalization in Canada can indeed be considered a public health success.

“Herb is the healing of a nation; alcohol is the destruction” – Bob Marley

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List of Acronyms

| | |
|-------|--|
| CADS | Canadian Alcohol and Drugs Survey |
| CBD | Cannabidiol |
| CCHS | Canadian Community Health Survey |
| CHMS | Canadian Health Measures Survey |
| CHSCY | Canadian Health Survey on Children and Youth |
| CTADS | Canadian Tobacco and other Drugs Survey |
| NCS | National Cannabis Survey |
| THC | Tetrahydrocannabidiol |
| UCR | Uniform Crime Report |

Glossary

| | |
|----------------------|--|
| Analgesic | Of a drug acting to relieve pain |
| Cannabidiol | A crystalline, non-intoxicating cannabinoid found in cannabis and hemp |
| Cannabis | A dried preparation of the flowering tops or other parts of the cannabis plant, or a resinous extract of it smoked or consumed, as a psychoactive (mind-altering) drug |
| Criminal | An illegal act which can be punished by the government |
| Decriminalization | To remove the criminal classification or status of |
| Hash | An extract of the cannabis plant containing concentrates of the psychoactive resins |
| Hemp | The fibre of the cannabis plant, extracted from the stem and used to make rope and other strong fabrics |
| Legal | Permitted by the law |
| Legalization | The act of making something that was previously illegal permissible by law |
| Marijuana | Slang term for cannabis |
| Prohibition | The act of forbidding something, especially by law |
| Regulation | The process of being controlled by means of rules or the law |
| Tetrahydrocannabinol | A crystalline compound that is the main active ingredient of cannabis |

Chapter 1.

Introduction

1.1. Global cannabis regulation history

Before cannabis was a prohibited substance, it was used by civilizations throughout the world for clothing and medicine, in addition to its psychoactive properties. While hemp and cannabis had been used for many purposes throughout the world for thousands of years, cannabis was not mentioned in any formal medical texts in North America until the early 19th century (Abel, 1980). While cannabis continued to be used for medical purposes, cannabis prohibition began in North America in the early 20th century, fueled largely by racist ideologies in both the United States and Canada (Boyd, 2019). Cannabis continued to be outlawed in both countries despite recommendations to the government through both the Shafer and LeDain Commissions, that personal possession of cannabis should be decriminalized, and evidence that the substance did not have as many harmful effects as previously thought (MacKay & Phillips, 2016). Despite the so-called “war on drugs” in the United States, slowly, and through landmark decisions of the Supreme Court of Canada and ballot initiatives in a number of the United States, cannabis came to be legalized for legitimate medical use. This marked a shift in the approach to cannabis policy in North America. Generally, cannabis policy has been separated between medical and recreational use. Over time, cannabis regulation has shifted from a criminalized prohibition approach to an approach that now focuses on public health. In 2012, ballot initiatives led to the legalization of recreational cannabis in Colorado and Washington State. Uruguay has also legalized cannabis for recreational purposes, while the Netherlands has decriminalized the use and distribution of small amounts of the substance. On October 17, 2018, cannabis became legal in Canada to purchase and use for recreational purposes, marking yet another significant shift to global cannabis policy.

1.2. Before prohibition

The earliest record of human use of cannabis comes from Taiwan, an island located off the coast of China. Discoveries of early Chinese fabrics show that the ancient Chinese wove their clothes from hemp, and used the fiber to manufacture shoes. At this time, hemp was used to manufacture garments only. Around 28th century B.C., the Chinese began to use cannabis for its medicinal properties and as a means to relieve the sick (Abel, 1980). By the second century AD, Chinese medicine was the most advanced in the world, and it was discovered that cannabis resin mixed with wine was an effective analgesic (Booth, 2003). The Chinese were the first people on record to use cannabis for clothing and for medicine; they were also the first people to record experiencing the psychoactive effects of cannabis (Abel, 1980). Although cannabis was used for its psychoactive properties, this was short lived in China, as the use of cannabis for non-medicinal purposes was widely frowned upon (Booth, 2003).

The knowledge of cannabis eventually spread from China to Japan. Hemp fiber was highly regarded among the Japanese, and was used primarily for clothes, bedding, mats, and nets. Hemp was also used in Japan for ceremonial purification and to drive away evil spirits. In China, evil spirits were banished from the bodies of the sick by banging hemp rods on the head of the sickbed. In Japan, similar ceremonies were performed with a short stick of undyed hemp fibers (Abel, 1980). From China, the knowledge of cannabis, and likely the seeds of the plant itself, moved west to India. In India, cannabis was first used by priests and holy men who used cannabis to “bring them closer to enlightenment” (Booth, 2003, p. 21). Cannabis was also used to prolong sex and meditation, in addition to calming the nerves of soldiers going into battle. It was also commonly used as a medicine to treat dysentery, insomnia, and fear (Booth, 2003). In addition, hemp and cannabis were used in ancient Egypt, Grecian doctors possessed a knowledge of cannabis, and both the Greeks and Romans traded hemp for its fiber, as it was noted that hemp made exceptionally strong rope (Booth, 2003).

The first solid evidence of hemp use in Western Europe comes from a fifth century urn discovered by a German archaeologist. It is unclear whether the hemp was locally grown or imported. With the expansion of the Roman Empire, the cultivation of hemp became commonplace. Around 400 AD, the cultivation of hemp reached Britain (Booth, 2003). At the same time, Vikings used hemp for rope, fishing line and sailcloth.

This supports the idea that the Vikings may have introduced the plant to the “New World”. Further, the Venetians founded their own hemp industry operated through a state owned factory. After the demise of Venice, Italy was exporting hemp to England, Portugal, Germany, Spain, and Switzerland (Booth, 2003).

It is unclear when hemp reached what is now known as North America. The Vikings may have introduced it to Indigenous persons before European colonization of the territory began. Alternatively, it could have spread to the west by Chinese explorers. In English colonies, hemp cultivation was mandatory from 1611. By the outbreak of the War of Independence, most Western colonies were self-sufficient in producing hemp. Any surplus was exported mostly to the French. The 1830's saw a rapid increase of hemp machinery. However, after the Civil War, cotton came to dominate the fiber industry, and by the 1870s and 80s, hemp production was greatly reduced. It seemed as though hemp was no longer a staple as a source of fiber (Booth, 2003).

In America, hemp had been a valuable staple for agriculture since the beginning of colonization in the lands now known as the State of Virginia. However, Americans were unaware of the psychotropic effects that could come from using the plant in other ways. It was not until Americans read of the exploits of Bayard Taylor, an American explorer, that they learned of the existence of hashish. During his travels to the Middle East, Taylor became acquainted with hashish, an experience that he described in two books (Abel, 1980). Taylor's writings prompted individuals to try using the substance themselves in order to determine whether they could also experience some of the effects of the drug. Taylor's writings became some of the first introductions of hashish to Americans (Abel, 1980).

In 1843, cannabis was first mentioned in formal medical texts in the United States. The United States Dispensatory began to list cannabis as a medicinal substance. However, it was noted that cannabis could cause “alarming effects” if prescribed in high enough doses. With difficulty administering the substance and a lack of knowledge surrounding its use, physicians in the late 1800s had little interest in the potential therapeutic benefits of the substance. Despite the writings of prominent explorers, in addition to the medicinal uses of cannabis, the use of cannabis in the United States was relatively rare. The use of hashish was confined mostly to large cities in the early to mid-1900s, and most Americans would likely not have heard about cannabis or hashish until

the 1960s (Abel, 1980). In Canada, cannabis was largely unknown until 1908, and while other jurisdictions such as the United States and Italy began initiatives to include cannabis in a list of prohibited drugs along with opium and cocaine, Canada did not include cannabis as a prohibited substance. Cannabis in Canada was generally unregulated until the 1920s when articles about the harms of cannabis began to be published in Maclean's magazine (Abel, 1980).

1.3. Cannabis prohibition in America

Racism helped to spur cannabis prohibition in many of the United States in the early 20th century. Cannabis in 20th century America continued to be identified with a small percentage of certain racial minorities such as Mexicans and African Americans. Stories of violent crimes committed by so called "marijuana crazed criminals" ran in the press in the early 20th century. In the late 1800s, cannabis was increasingly being labeled as a poison, which clashed with the notion of people smoking it for recreational purposes (Oliver, 2016). Nationwide cannabis prohibition began in the United States in the early 1900s with the passage of the *Pure Food and Drug Act* (1906). This was the first national piece of legislation in the United States, to formally regulate cannabis along with alcohol, opiates, and cocaine. The substances were listed as intoxicating ingredients whose presence was required to be included on product labels. Under the *Pure Food and Drug Act*, United States officials prohibited the importation and use of cannabis for anything other than medicinal purposes (Lee, 2012).

Cannabis was prohibited nationwide by 1937. This prohibition began with a national narcotics policy in 1914. The use of opiates was becoming an increasing problem in the country, partly a product of the widespread use of morphine during the Civil War. The first federal legislation against narcotics was the *Harrison Narcotics Tax Act* (1914) (Schaller, 1920). The *Harrison Act* extended federal control over narcotics so that no individual could possess, import or distribute opiates or cocaine for non-medical purposes. This was the first distinction ever made between medical and recreational substances (Lee, 2012). The *Act* was used to tax the importers and sellers of opium and its derivatives. In 1912, *The Hague International Opium Convention* was signed by representatives from China, France, Germany, Italy, Japan, the Netherlands, Iran, Portugal, Russia, Thailand, the UK, and the British overseas territories. The *Convention* contained many elements of a comprehensive drug control treaty, and was an official

declaration on the dangerous practices of opium smoking and the non-medical trade of opium and other drugs including cocaine and heroin. The *Hague Convention* (1912) contributed to drug prohibition in many countries, and inspired national drug control legislation, including the *Harrison Act* (United Nations Office on Drugs and Crime, 2019). However, the *Harrison Act* did not cover cannabis. In 1930, Harry H. Anslinger was appointed the Assistant Minister of Prohibition under the Bureau of Narcotic's Treasury Department (Schaller, 1970). However, in the 1930s, most of middle-class, white America had almost no contact with cannabis. In 1930, only 16 states had placed restrictions on cannabis, and these restrictions were generally mild and unenforced. At this time, the Federal Bureau of Narcotics was formed, and urged state legislatures to pass the *Uniform State Narcotics Act* (1935), and to include cannabis in their lists of prohibited substances (Slaughter, 1988).

After consulting with Anslinger, the United States Treasury Department began to prepare its case to Congress for outlawing cannabis. Anslinger came prepared with a number of horror stories, which claimed that cannabis was causing everyday Americans to commit crimes, and that the substance was "deadly". During the hearings, no estimates of how many Americans were using cannabis was discussed. In addition, no qualified experts were called upon to support the Federal Bureau of Narcotic's claim that cannabis was such a harmful substance (Abel, 1980). The bill was passed by the House of Representatives and was sent on to the Senate. There was virtually no debate surrounding the federal prohibition of cannabis. The bill outlawing cannabis was signed into law by President Roosevelt on August 3, 1937 (Abel, 1980).

1.4. The Shafer Commission

After World War II, both federal and state penalties for cannabis possession and distribution increased dramatically. In 1951, the federal *Boggs Act* mandated two to five years of imprisonment for possession of any amount of cannabis. However, in the 1960's, cannabis began to become a pastime of millions of middle-class youth. Inexpensive Mexican cannabis became readily available in the late 1960s. Fewer than one million Americans had tried cannabis by 1965, but by 1972, twenty-four million people had tried cannabis at least once, and eight million people were using it regularly (Slaughter, 1988). The number of annual arrests for cannabis offences went from 20,000 in 1965 to 421,000 by 1973. The majority of these arrests were for possession of small

amounts of cannabis (usually less than 1 ounce). The United States Congress responded to the uptake in the use of cannabis, and lowered the maximum penalty for possession of an ounce of cannabis (~30g) to one year in prison and a \$5000 fine (Schaller, 1970).

To address the issues associated with cannabis prohibition in America, Congress in 1970 directed the formation of the National Commission on Marihuana and Drug Abuse. The 1972 report, *Marihuana: A Signal of Misunderstanding*, refuted the logic underlying the prohibition of cannabis and encouraged state legislatures to reduce sanctions for cannabis possession offences (Slaughter, 1988). Chaired by former Pennsylvania Governor Raymond Shafer, the National Commission (also known as the Shafer Commission) recommended that federal and state laws be changed to decriminalize possession of small amounts of cannabis. The commission also recommended that possession of small amounts of cannabis be dealt with through confiscation of the substance if found on a person in public. Based on scholarly evidence, the commission concluded that cannabis use (for short term or recreational purposes) did not pose a major threat to public health (Slaughter, 1988). The study dismissed the theory that cannabis use caused violent crime and delinquency, as well as the idea that those who use cannabis would progress to the use of more “dangerous” substances. The Shafer Commission’s Report successfully dispelled the misconceptions of the dangers of cannabis that had been the foundation of cannabis policy until the late 1960’s (Slaughter, 1988). Despite the findings of the Shafer Commission’s Report, President Richard Nixon disagreed with the conclusions that cannabis possession should be decriminalized. Although the Shafer Commission’s report did not bring about the decriminalization of cannabis possession in the United States, it helped set in motion limited cannabis law reform in the 1970’s (Slaughter, 1988).

1.5. Changing approaches

While the conclusions of the Shafer Commission Report indicated that cannabis use did not cause crime and delinquency nor did it act as a “gateway” for users to progress to using allegedly “harder” substances, cannabis remained illegal in all 50 of the United States both at the state level and under federal law. This changed however in 1973 when Oregon became the first state to remove criminal penalties for personal use of cannabis, and brought in a regulatory scheme (Oliver, 2016). This change made

possession of small amounts of the substance no longer criminal, although it did not make cannabis legal by any means. Like a speeding violation, anyone caught with small amounts of the substance could be issued a ticket. Following Oregon, many states began to consider regulating instead of criminalizing cannabis, and in the following five years, eight more states moved to decriminalize and regulate small amounts of cannabis. Eventually, 17 states decriminalized possession of cannabis for personal use. However, the Drug Enforcement Administration reaffirmed that cannabis would continue to be criminalized by the federal government (Oliver, 2016).

The decade of the 1980s saw the emergence of the “War on Drugs” in America. The presidencies of Ronald Reagan and George H.W. Bush made the fight against illicit drugs a central component of their presidential campaigns. Federal drug policy targeted cannabis consumers and producers, and federal dollars were provided for the states and jurisdictions that maintained laws criminalizing the use of cannabis (Oliver, 2016). In 1990, a federal law was passed under the Bush administration that required states to suspend driver’s licenses of all convicted drug offenders or risk losing part of their federal funding. This measure applied to all drug offences, including simple possession of cannabis (“States are pressed”, 1990, para. 1). In 1995, the United States Government implemented mandatory minimum sentences for drug offences, as well as introduced “Three Strikes” legislation. This statute attempted to curb violent crime by implementing a sentence of mandatory life imprisonment if an individual were to be convicted of three felonies. This legislation would apply to those convicted in federal court of a “serious violent felony,” and with two or more prior convictions in either federal or state court, with at least one being a “serious violent felony.” Other offences included in this legislation were “serious drug offences”, defined as those offences including continuing criminal enterprise, offences involving the distribution, manufacture or possession with intent to distribute significant quantities of controlled substances, or equivalent state level offences (The United States Department of Justice, 1995, paras. 8-13).

The issue surrounding cannabis criminalization in the United States came to a head in 1996 when California became the first state to pass a law by way of proposition, legalizing cannabis for medicinal purposes. By legalizing cannabis for medical purposes, California had allowed for the legal sale and growth of the substance throughout the state, despite the fact that it remained illegal at a federal level (Oliver, 2016). As a result,

under a new federal task force, the Drug Enforcement Administration targeted a California medical cannabis grower, leading to a Supreme Court case with the central issue surrounding jurisdictional conflicts under federalism. The Supreme Court ruled that the federal government's laws outlawing cannabis superseded California's law on medicinal cannabis (Oliver, 2016).

Despite this ruling by the Supreme Court, a number of other states ignored both the ruling and the federal law, and began passing medical cannabis legislation. By 2014, 23 states and the District of Columbia had regulatory frameworks allowing for the sale of medicinal cannabis. This created a problematic situation for the United States federal government, which then had to decide to what extent to enforce national laws in states that permitted the sale of medical cannabis. In 2009, under directives from the Obama administration, the Drug Enforcement Administration stated that they would no longer raid stores that sold medical cannabis, backing down from enforcing federal laws (Oliver, 2016). In 2012, state approaches to cannabis policy changed drastically when Colorado and Washington State placed initiatives for the legalization of recreational cannabis on the ballot, and citizens of these two states voted to make recreational cannabis legal. Colorado became the first state to implement the law with Washington soon following. In 2014, Alaska, Oregon, and the District of Columbia also moved to legalize cannabis for recreational purposes, greatly undermining federalism and national drug policy in America, as well as other international drug policy commitments (Oliver, 2016).

1.6. Cannabis prohibition in Canada

Narcotics legislation and drug prohibition began in the early 1900s in Canada. It is important to note the difference in criminal-law writing powers between the United States and Canada – criminal-law writing is only a federal jurisdiction in Canada, while in the United States; states have criminal-law writing powers. Up until 1908, there were no federal restrictions against any drugs in Canada. However, an economic crisis and clearly racist ideals towards Chinese Canadians in British Columbia caused the House of Commons to outlaw opium. In 1908, the criminalization of certain drugs began, when an Act to prohibit the importation, manufacture, and sale of opium for anything other than medicinal purposes was passed by Wilfred Laurier's federal government (Boyd, 2015, p. 51). The first drug to be criminalized was opium—prohibited regardless of the few expressions of concern surrounding the distribution and use of the substance. Chinese

individuals in British Columbia generally operated opium-smoking businesses. Some Chinese workers who had been encouraged to come to Canada to help build the Canadian Pacific Railway in the 1870s brought the substance with them. By 1900, Canada was experiencing a labour shortage, and Chinese workers—who were facing few economic options—were paid half the wages of white workers. This fueled existing and widespread racism. When the economy entered into a recession at the turn of the 20th century, job losses led to an “Anti-Asian” riot in Vancouver, BC, where angry white workers destroyed most of what was then known as “Chinatown” and many of the opium manufacturing businesses. In refusing to acknowledge the racially and economically motivated violence, the government instead began raising its concerns about the harms of smoking opium, and shortly thereafter, prohibited its sale, importation and manufacture (Boyd, 2015, p. 53). Prohibition of the use of opium for anything other than medical purposes became enshrined in Canadian law with the passage of the *Opium Act* (1908) (MacKay & Phillips, 2016). This would eventually lead to the prohibition of other drugs throughout the early 1900s.

Cannabis was virtually unknown in Canada in 1908. In 1909, Canada participated in the International Conference on Opium in Shanghai. At this time, Canada did not support the American and Italian initiatives to include cannabis in the list of prohibited drugs (Abel, 1980). In 1911, Canada passed the *Opium and Drug Act*. This new law broadened the ban against opium by adding morphine and cocaine to the list of prohibited substances; however, cannabis was still not mentioned. Cannabis in Canada continued to be ignored until the 1920’s when Emily Murphy, a Canadian suffragist who wrote under the pen name of “Janey Canuck”, began writing about the harms and horrors of the substance for Maclean’s magazine (Abel, 1980).

Emily Murphy fought for the rights of women to be declared persons under the law, and was the first woman judge to be appointed in the British Empire in 1916. However, Murphy held overtly racist opinions and stood vehemently against all drugs associated with racial minorities, as cannabis was during this time. She wrote many pieces on what she saw as a “drug problem in Canada” for Maclean’s magazine in the 1920s, including an essay noting that the Chinese and “Negroes” in Canada craved nothing more than drugs and the “seduction of Canadian women” (Abel, 1980). Quoting American authorities such as Henry Anslinger, she argued that cannabis (although virtually unknown in Canada at the time) drove its users completely insane. Murphy’s

writings were sensational and xenophobic but they were also so popular in Canada that they were eventually collected into a book, *The Black Candle* (1922). Through her writing, Murphy was successful in single-handedly altering Canadian views of drugs and drug users.

Cannabis was first prohibited in Canada in 1923, when it was added to the *Opium and Narcotic Drug Act* (MacKay & Phillips, 2016). This policy change was largely influenced by Murphy's writing. By 1929, penalties for the distribution and sale of opium, cocaine, and cannabis had risen to a maximum of seven years' imprisonment (Boyd, 2015, p. 57). Although recreational use of cannabis was outlawed in 1923, Parliament grew even more intolerant to the substance in the following years. In 1938, the government prohibited anyone from growing cannabis without a permit from the Department of Health. Further, in 1961, Canada ratified the *UN Single Convention on Narcotic Drugs* and adopted the *Narcotic Control Act* in order to implement the provisions outlined in the *UN Convention* (MacKay & Phillips, 2016). The purpose of the *UN Convention* was to combat drug abuse through coordinated international action. This intervention included limiting the possession, use, trade, distribution, import, export, manufacture and production of drugs to medical and scientific purposes only. In addition, the *Convention* aimed to combat drug trafficking through international cooperation to deter and discourage drug traffickers (United Nations Office on Drugs and Crime, 2018).

1.7. The LeDain Commission

In 1972, the LeDain Commission was created in order to inquire into the non-medical use of drugs. The commission was tasked with gathering research, holding public hearings, and interviewing medical and law enforcement experts in order to determine how drug legislation may be changed to respond more usefully to the increasing use of illegal substances (Boyd, 2015, p. 57). The commission submitted its report to the government, advocating for the abolition of the criminal offence of possession of cannabis, and a shift in the philosophy on drug prohibition from a model of enforcement, towards less strict criminal sanctions for drug offences (Boyd, 2015). The committee concluded that Canada's policy of criminalization of cannabis possession created harms that were disproportionate to the harms associated with cannabis use (MacKay & Phillips, 2016). However, similar to the Shafer Commission Report, these

recommendations by the commission were never enforced or acted upon by the Canadian government.

1.8. From the LeDain Commission to the new millennium

While the Canadian government failed to act upon the recommendations of the LeDain commission, this did not halt attempts to make changes to cannabis policy across the country. Despite the report by the LeDain commission, the Liberal government in 1979 signed the *UN Convention on Psychotropic Substances*. This decision was heavily influenced by the newly elected Reagan-Bush administration in the United States with the ever-popular “War on Drugs” campaign. By signing on to this convention, the Canadian government halted any plans to legalize cannabis (Spicer, 2002). Throughout the 1980s, the Reagan-Bush administration carried out the “War on Drugs” campaign. In Canada, regular Gallup polls showed that cannabis use was stabilizing, and had even been decreasing among the youth population during this time. This may have been due to a number of measures implemented by national, provincial, and local jurisdictions in order to suppress cannabis use and the cannabis trade in Canada (Spicer, 2002).

In 1987, Canada launched a 5-year drug strategy pioneered by Prime Minister Brian Mulroney, who declared that drug abuse had become an epidemic that undermined the economic and social fabric of Canada (House of Commons Canada, 2002). The Government of Canada allocated \$210 million to support this new strategy, with a focus on demand-reduction measures such as education, prevention, treatment, and rehabilitation (House of Commons Canada, 2002). In 1992, Cabinet renewed its commitment to Canada’s Drug Strategy, launching the second phase of this initiative. In 1998, the Government of Canada reaffirmed the principles of the National Drug Strategy; however, funding for the program was significantly reduced at this time. The mid-1990s saw the rise of the cannabis decriminalization movement joined by hundreds of cannabis users who argued that Canada’s laws regarding cannabis prohibition were outdated and poorly aligned with a mandate of public health. Despite these protests, the Canadian Government passed the *Controlled Drugs and Substances Act* (1996) with penalties for use, possession and distribution of cannabis, albeit with slight reductions in penalties for cannabis and the creation of a separate schedule for the drug. The *Controlled Drugs and Substances Act* replaced the *Narcotic Control Act*, combined the regulations within it

with the *Food and Drugs Act*, and repealed some additional provisions in the *Food and Drugs Act* (Spicer, 2002).

Despite its continued prohibition, cannabis continued to be consumed and produced in Canada. In the 1980s and 90s, Canadians began to move away from the importation of cannabis to domestic production of the substance. In the early 1980s, the RCMP seized large amounts of imported cannabis and hashish. During this time, users cultivated their own cannabis for personal use in both rural and urban areas. By the late 1980s, the number of individuals charged with cannabis cultivation offences in Canada continued to rise. In the late 1980's, approximately 20% of cannabis in Canada was domestically produced. By 1993, more than 30% of Canada's cannabis supply was grown domestically (Lafrenière & Spicer, 2002). In 1996, indoor cultivation facilities were reported by the RCMP to be increasingly complex and sophisticated. By 1999, as reflected in the number of cannabis cultivation charges which had reached unprecedented levels, Canada's share of the cannabis market had increased to 50%. At this time, it is estimated that around 800 tonnes of cannabis was being produced in Canada annually, representing 4.7 million cannabis plants produced per year (Lafrenière & Spicer, 2002).

1.9. *R v. Parker, R v. Krieger*¹

There are a number of legal cases that demonstrate changing approaches by Canada's courts regarding cannabis prohibition. In 1996, Terrence Parker was charged with possession of cannabis for the purposes of trafficking and cannabis cultivation contrary to the *Narcotic Control Act* after police officers seized 71 cannabis plants from his home. At the time of the offence, Parker had suffered from epilepsy for nearly 40 years. Parker had been prescribed a number of medications for the treatment of his condition in addition to undergoing two brain surgeries, which removed brain material in an attempt to control the severity and frequency of his seizures. Neither the medication nor the surgeries were successful in reducing the episodes (*R v. Parker*, 2000). Parker discovered that cannabis, when used in conjunction with his prescription medication, was successful in reducing the frequency and severity of his seizures. Thus, he began cultivating his own cannabis plants for personal use, as he was unable to locate a legal

¹ *R v Krieger*, [2006] 2 SCR 501; *R v Parker*, [2000] 49 OR (3d) 481

source to obtain the substance. When charged with various cannabis offences, Parker argued that by not allowing him to consume cannabis for medical purposes, it violated his rights to life, liberty, and security of the person under section 7 of the *Canadian Charter of Rights and Freedoms* (*R v. Parker*, 2000).

The court agreed with Parker's argument that the prohibition of the possession of cannabis did in fact violate his right to liberty and security of the person, and agreed that since there was no legal source of cannabis, that Parker's only practical way of obtaining the cannabis he required for his medical needs was to cultivate it himself. The court also declared the provisions surrounding cannabis prohibition under the new *Controlled Drugs and Substances Act* (1996) to be invalid (*R v. Parker*, 2000). However, the court suspended the declaration of invalidity for a period of 12 months providing the federal government with time to create new cannabis legislation, which considered those using cannabis for medical purposes. A second case, *R v Krieger* (2006), affirmed that the *Narcotic Control Act* prohibitions violated the right to life, liberty, and security of the person regarding legitimate medical access to cannabis and adequate access provisions for therapeutic cannabis (Fischer, Ala-Leppilampi, Single & Robins, 2003). Both of these decisions were substantial in leading to the implementation of the first regulations allowing the medical use of cannabis in Canada, the *Marihuana Medical Access Regulations* (Hereinafter, *MMAR*) in 2001.

1.10. *R v. Malmo-Levine; R v. Caine*²

In contrast to the decision in both *R v. Parker* and *R v. Krieger* which dealt with access to medical cannabis, in 2003 the Supreme Court of Canada dismissed a constitutional challenge to the overall prohibition of cannabis in Canada. The appellants Malmo-Levine and Caine challenged the prohibition of simple possession of cannabis, in addition to the possession of cannabis for the purposes of trafficking. The appellants argued that parliament lacked the authority to criminalize cannabis possession, and that personal use of cannabis did not cause harm to other individuals or society, and thus should not be criminalized (*R v. Malmo-Levine; R v. Caine*, 2003). The appellants challenged the law arguing that it violated their *Charter* protected rights under section 7, the right to life, liberty, and security of the person, under section 12, the right to be free

² *R. v. Malmo-Levine; R. v. Caine*, [2003] 3 SCR 571

from cruel and unusual punishment and treatment, and under section 15, the right to equality. The appellants contended that unless the state could establish that cannabis use is harmful to others, section 7 rights were infringed by the criminal prohibition, and that the absence of demonstrated harm to others deprives parliament of the power to impose criminal liability (*R v. Malmo-Levine; R v. Caine*, 2003). Further, they argued that criminalization of cannabis discriminated against a group of people on the basis of their substance orientation and/or occupational orientation.

The court dismissed the appeals, arguing that there is no consensus that harm to others is the sole justification for criminal prohibition, and that there are several examples of crimes that do not cause harm to others found within the *Criminal Code*. Thus, they found that the prohibition of cannabis for personal use as well as for the purposes of trafficking did not infringe on an individual's s. 7 rights under the *Charter*. In addition, they argued that cannabis prohibition also did not violate an individual's equality rights as, "a taste for marijuana is not a 'personal characteristic' in the sense required to trigger s.15 protection... It bears no analogy with the personal characteristics listed in s. 15, namely race, national or ethnic origin, colour, religion, sex, age, or mental or physical disability" (*R v. Malmo-Levine; R v. Caine*, 2003, para. 185). This case was unsuccessful in bringing about a change to cannabis policy in Canada; however, the Supreme Court of Canada was split in its decision. Three justices agreed that prohibiting the possession of cannabis for personal use did infringe upon an individual's right to life, liberty and security of the person under section 7 of the *Charter*, and that this infringement could not be reasonably justified. As stated by Arbour, J., writing for the minority:

I am of the view that the principles of fundamental justice require that whenever the state resorts to imprisonment, a minimum of harm to others must be an essential part of the offence. The state cannot resort to imprisonment as a punishment for conduct that causes little or no reasoned risk of harm to others. Prohibited conduct punishable by imprisonment cannot be harmless conduct or conduct that only causes harm to the perpetrator (*R v. Malmo-Levine; R v. Caine*, 2003, para. 244).

While this case did not lead to a change in cannabis legislation, the dissenting opinion hinted at changes to come with respect to cannabis policy in Canada, and provided a new perspective on the possession of cannabis for personal use.

1.11. Attempted changes

Three decades after the LeDain commission report, the pressure to change the legal status of cannabis in Canada remained. This resulted in Parliament creating two committees to study the problem of illicit substances in Canada. In 2002, the House of Commons Special Committee on the Non-Medical Use of Drugs and the Senate Special Committee on Illegal Drug Use both released reports. Both committees recommended reforming cannabis laws on possession and supply (Hathaway, 2009). The House Committee recommended decriminalizing the possession and cultivation of small amounts (up to 30 grams) of cannabis. The Senate committee argued that cannabis should be legalized in Canada, and recommended that the production and sale of cannabis be licensed, while maintaining criminal penalties for illegal trafficking and export, and for all activities falling outside the scope of the exemption for production and sale (Senate of Canada, 2002). The Senate's view differed from both the LeDain Commission and the House committee in that the Senate recognized both the social harms of cannabis prohibition and the violation of the cannabis user's rights, arguing that the law should not be used to restrict behaviours that do no harm to others (Hathaway, 2009). While is this a valid argument by the Senate regarding the reasons why personal cannabis possession and use should be legalized, this reasoning does not hold with respect to the distribution or production of cannabis for the purpose of sale.

In 2002, Prime Minister Jean Chretien introduced Bill C-38 in an attempt to decriminalize and regulate possession for personal use of small amounts of cannabis. The bill proposed that those found to be in possession of less than 15 grams of cannabis would be punished through civil fines, while possession of between 15 and 30 grams of cannabis would be punished as a summary conviction offence, with a potential punishment of imprisonment of no more than six months (Bill C-38, 2002). While Chretien's government in the early 2000's proposed this bill, the bill did not gain enough support to make it to the second reading in the House of Commons (Bill C-38, 2002). Many cite pressure from the United States government, the Drug Enforcement Administration, and the war on Drugs as the reason for the bill's death. Subsequently, in 2004, Paul Martin's Liberal government attempted to decriminalize cannabis by introducing an identical measure to that introduced under the leadership of Jean Chretien. Bill C-10 (2004) proposed the removal of prison terms for simple possession of

less than 15 grams of cannabis. Individuals found to be in possession of small amounts of the substance would face the equivalent of a traffic ticket costing anywhere from \$100 to \$500 (Clark, 2004). Unfortunately, this second bill never made it through the House of Commons, and Paul Martin's Liberal government was defeated by the Conservative government, then led by Stephen Harper, who preferred a 'tough on crime' approach to drug use, possession, and manufacturing (Clark, 2004).

1.12. Tough on crime and mandatory minimum sentences

Beginning in 2006, Stephen Harper, Canada's 22nd Prime Minister, and his Conservative government, implemented a host of legislative changes with the goal of tackling crime, holding offenders accountable, and allegedly making communities safer (Comack, Fabre, & Burgher, 2015). One of the tough on crime strategies implemented by the Harper government was the *Safe Streets and Communities Act*, which received Royal Assent in March of 2012. While the goals of this legislation were to better protect youth from sexual predators, protect the public from violent young offenders, and to support victims of crime and terrorism, one of the main goals of this legislation was to increase penalties for organized drug crime. The *Safe Streets and Communities Act* (2012) provided for mandatory minimum penalties for drug offences, when such offences were carried out for the purposes of organized crime, or if the crime targeted youth. Not only did the *Act* increase the maximum penalty for cannabis production from 7 to 14 years, it also introduced a number of mandatory minimum sentences for offences involving cannabis (*Safe Streets and Communities Act*, 2012).

First, the legislation provided for a minimum term of imprisonment of six months for growing five or more cannabis plants (Boyd, 2015). In addition, individuals would be subject to imprisonment for a minimum term of one year if found guilty of trafficking cannabis for the benefit of a criminal organization, using or threatening to use violence, or if the individual used or threatened to use a weapon in the commission of the offence (*Safe Streets and Communities Act*, 2012). In addition, individuals would be liable to a minimum term of two years' imprisonment if they were found guilty of trafficking cannabis on or near a school grounds or any other place frequented by those under 18 years of age (*Safe Streets and Communities Act*, 2012). A number of Canadian judges have even struck down the provision describing it as "cruel and unusual punishment". During this time, jurisdictions in the United States were regulating the distribution and

recreational use of cannabis. With the election of Justin Trudeau's Liberal government in 2015, Canada has taken a new approach to cannabis legislation (Boyd, 2019, p. 57). Despite nearly a century of prohibition and a tough on crime approach to cannabis policy, Canada has now moved away from a tough on crime approach to recreational cannabis legalization. Although Canada has moved to legalize cannabis for recreational purposes across the country, it was certainly not the first jurisdiction to regulate recreational cannabis.

1.12.1. Global cannabis law reform

Regulations surrounding cannabis prohibition have been shifting in recent years. Recently, Uruguay and the two United States of Colorado and Washington have taken steps to legalize and regulate the production, distribution and sale of cannabis for recreational purposes (Pardo, 2014). Many of these policy changes are being made following changes to medical cannabis legalization in a number of global jurisdictions. Cannabis criminalization and policies of prohibition have undergone significant reform over the past several years, moving away from criminal penalties outlined under international drug control frameworks (Pardo, 2014). Reforms in the United States included allowing medical access to cannabis, and European policy reforms included some means of permitting and regulating access to cannabis for non-medical purposes. The Netherlands allows for the purchase and sale of small amounts of cannabis in "coffee shops", and Colorado, Washington State and Uruguay (now along with many other jurisdictions in the United States) have legalized cannabis through codified laws and regulations. Table 1 outlines some of the recent changes to cannabis policies in global jurisdictions.

Table 1. Comparison of cannabis laws and regulations in the Netherlands, Colorado, Washington and Uruguay

| | The Netherlands | Colorado | Washington State | Uruguay |
|--|--|--|--|-----------------------|
| Level of law | National | State-level | State-level | National |
| Method of legalization | Government initiative | Ballot initiative | Ballot initiative | Government initiative |
| Date of legalization | 1976 formal written policy of non-enforcement for cannabis possession up to 30g – use of cannabis formally decriminalized in <i>Opium Act 1976</i> | November 2012 | November 2012 | December 2013 |
| Minimum age | 18 | 21 | 21 | 18 |
| Personal possession quantity | 30g | 28.5g | 28.5g | 40g |
| Penalties for unauthorized personal possession | Possession of up to 30 g a “petty offence” (5-30g), possession of over 30g of cannabis a criminal offence (Korf, 2002) | Includes a fine of up to \$100. Penalties for distribution, trafficking and sale of more than once ounce of cannabis still remain, and can range from a \$100 to \$750,000 fine and up to 12 years imprisonment (Steiner, 2019). | Up to a \$1000 fine or up to 90 days imprisonment (Pardo, 2014). | None |

1.12.2. Cannabis legalization in Canada

Medical cannabis

Legal access to cannabis for medical purposes was first approved in Canada in 1999, as a result of *R v. Parker*. This decision by the Supreme Court of Canada led to the implementation of the *Marihuana Medical Access Regulations (MMAR)* in 2001. The *MMAR* allowed individuals (with the authorization of a health care practitioner) to access dried cannabis for medical purposes. Individuals could do so by growing their own cannabis plants, designating another individual to grow cannabis plants on their behalf, or by purchasing dried cannabis from Health Canada. Under the *MMAR*, individuals could only purchase or grow dried cannabis for medical purposes (Health Canada, 2016).

In June 2013, the Government of Canada implemented the *Marihuana for Medical Purposes Regulations (MMPR)*. Under the new *MMPR* regulations, individuals with a medical need could purchase cannabis from licenced producers, responsible for quality-controlled environments, and with the cannabis produced in secure and sanitary conditions. In 2015, the Supreme Court of Canada ruled that restricting medicinal access to only dried cannabis was unconstitutional in *R v. Smith*. The court held that individuals with a medical need should have the right to use and make other cannabis products in addition to dried cannabis. Under the *MMPR*, the Minister of Health allowed licensed producers of cannabis to produce and sell cannabis oil and fresh cannabis buds in addition to dried cannabis (Health Canada, 2016).

The *MMPR* were repealed in 2016 in order to enact the new *Access to Cannabis for Medical Purposes Regulations (ACMPR)*. The *ACMPR* were the Canadian government's response to *Allard v. Canada* (2016). This decision held that requiring individuals to obtain medical cannabis from licensed producers alone violated an individual's right to life, liberty, and security of the person (section 7 of the *Charter*). The court found that those who require cannabis for medical purposes did not have "reasonable access" to the substance (Health Canada, 2016). The *ACMPR* outlined a framework for the commercial production and distribution of quality-controlled cannabis, including fresh cannabis, dried cannabis, cannabis oil, and cannabis seeds and plants. In addition, the *ACMPR* set out the new regulations for individuals to produce a limited

amount of cannabis or to designate another individual to produce it for them (Health Canada, 2016).

Under the *ACMPR*, Health Canada was responsible for licensing and overseeing the commercial medical cannabis industry, and for registering individuals to produce a limited amount of cannabis for their own medical purposes (Health Canada, 2016). New activities under the *ACMPR* include the production and sale of “starting materials” such as cannabis seeds and plants, and the ability to obtain fresh or dried cannabis, as well as cannabis oil to those registered to receive cannabis for medical purposes (Health Canada, 2016). Individuals under the *ACMPR* could access medical cannabis in one of three ways: continue to access quality-controlled cannabis from licensed producers, register with Health Canada to produce a limited amount of cannabis for their own medical purposes, or designate another individual to produce cannabis on their behalf (Health Canada, 2016). Registered medical cannabis patients who violate the restrictions set out in the *ACMPR* would be liable to penalties under the *Safe Streets and Communities Act*.

Recreational cannabis

Justin Trudeau became Canada’s 23rd Prime Minister on November 4, 2015. As part of his election campaign, Trudeau vowed to legalize cannabis for recreational purposes in Canada. In the 2015 Speech from the Throne, the Canadian Government committed to introducing legislation to regulate, yet strictly restrict access to legal cannabis. In June 2016, the Minister of Justice, Minister of Public Safety, and the Minister of Health established the Task Force on Cannabis Legalization and Regulation to consult with Canadians and to provide advice on a new regulatory framework for cannabis consumption (Health Canada, 2017). This task force engaged in countrywide consultations with provincial, territorial, and municipal governments, in addition to experts, patients, indigenous organizations, youth, and those currently working in the cannabis industry. Based on these consultations, the Task Force delivered a final report “A Framework for the Legalization and Regulation of Cannabis in Canada” in December 2016. Some recommendations made by the task force included minimizing cannabis related harms, establishing a safe and responsible supply chain, public safety, and continued medical access to cannabis (Health Canada, 2017).

On April 13, 2017, the Government of Canada introduced *Bill C-45, an Act respecting cannabis and to amend the Controlled Drugs and Substances Act, the Criminal Code and other Acts* (hereinafter, the *Cannabis Act*) in the House of Commons. This bill created a comprehensive national framework to provide access to regulated cannabis, to control the production, distribution, sale, import, export, and possession of the substance. The act largely endorsed the conclusions of the Task Force on cannabis legalization. The *Act* would also allow provinces and territories to oversee the distribution and retail aspects of the cannabis supply chain, and to create certain guidelines in each respective jurisdiction (Health Canada, 2018).

Possessing, using, and distributing cannabis for recreational purposes received Royal Assent in Canada on June 21, 2018. The *Cannabis Act* creates a strict legal framework for controlling the production, distribution, and sale of cannabis across Canada. While the *Cannabis Act* was passed in the Senate on June 21, cannabis did not become legal to possess and purchase in Canada until October 17, 2018. The *Cannabis Act* has three main goals for cannabis legalization in Canada. These are: keeping cannabis out of the hands of youth, keeping profits out of the hands of criminals, and protecting public health and safety by allowing adults to access safe, quality controlled, legal cannabis (Department of Justice Canada, 2018).

As of October 17 2018, adults who are 18 years of age or older (subject to certain provincial restrictions) are able to possess up to 30g of dried cannabis, or an equivalent non-dried form in public. Individuals are also allowed to share no more than 30g of dried cannabis with other adults, buy dried or fresh cannabis and cannabis oil from a provincially licensed producer, grow up to 4 cannabis plants per residence for personal use, and to make edible cannabis products at home such as food and drinks (Department of Justice Canada, 2018). Under the new recreational cannabis regulations, individuals are able to possess dried cannabis, fresh cannabis, edible cannabis products, liquid cannabis products, cannabis concentrates, and plant seeds. Amounts for possession and distribution of these products were identified based on the equivalent amount of dried cannabis (Department of Justice Canada, 2018). Penalties for unauthorized personal possession under the *Cannabis Act* include a fine of not more than \$5000, a term of imprisonment of up to 6 months or both, or to a term or imprisonment of no more than 5 years less a day. (*Cannabis Act*, 2018).

Federal and provincial governments jointly share the goals of the *Cannabis Act*. The federal government's responsibilities are to set requirements for producers and manufacturers of cannabis, including (but not limited to) the types of products available for sale, packing and labelling requirements, and standardized serving sizes and potency (Department of Justice Canada, 2018). Provincial and territorial requirements include measures such as setting the minimum age for consumption, setting the personal possession limit in their jurisdiction, and determining where adults can consume cannabis. This Act helps keep Canadians who consume cannabis out of the criminal justice system, with criminal penalties aiming to target those acting outside the legal framework, such as through organized crime. Penalties range from warnings and tickets for minor offences, to criminal prosecution and imprisonment for more serious offences. For example, possessing more than 30 grams of cannabis can result in either a warning or fine for small amounts, or up to 5 years' imprisonment. Further, taking cannabis across Canada's borders, giving or selling cannabis to a youth, or using a youth to commit a cannabis related offense has a penalty of up to 14 years' imprisonment (Department of Justice Canada, 2018).

1.12.3. Conclusion

Cannabis use, prohibition, and legalization has a long and complex history worldwide. Cannabis criminalization has resulted from largely racist ideals in both the United States and Canada. A number of global jurisdictions have begun to alter their regulatory schemes with respect to cannabis, moving away from the criminalization of cannabis to regulating the substance in order to protect public health and safety. Over time, cannabis came to be recognized as a substance that could have therapeutic effects for individuals suffering from chronic conditions such as chronic pain, epilepsy and those undergoing cancer treatments. There has been a shift in viewing cannabis as simply a dangerous substance with mind-altering effects used exclusively by deviants and criminals. With the understanding of the therapeutic effects of cannabis came the regulation of cannabis strictly for medical purposes. Thus, there was a transformation in the belief of the harmful effects of cannabis and the racist ideals surrounding its criminalization. Cannabis came to be thought of as a substance that could be regulated for recreational purposes through a public health framework. Further, there has been a clear political re-framing of the issues surrounding cannabis use, with cannabis being

recognized as a substance that should be regulated similar to tobacco and alcohol (Lee, 2018). While it is extremely important to set up a public health framework for the regulation of cannabis, many jurisdictions are missing components that are central to a public health approach to cannabis legalization, such as regulating the potency, price and promotion of cannabis. It is also extremely important to have processes and procedures in place to measure the effects of cannabis legalization on the public health framework which has been established. This will allow policy makers to determine the success of various cannabis legalization frameworks. Examining the public health effects of recreational cannabis legalization is especially important in Canada, as the regulatory scheme for cannabis legalization is unprecedented. Currently, the success of the public health framework for cannabis legalization in Canada remains to be seen.

Chapter 2.

Literature Review

2.1. Cannabis legalization in Canada

On June 21 2018, Canada became the second country in the world (with Uruguay being the first) to legalize cannabis for recreational purposes at a federal level. With the legalization of cannabis, the Canadian government has promised to adhere to a public health approach in the implementation of the legislation. While there is no strict or agreed upon definition of a public health approach, there is a consensus among Canadian officials as to the main components of a public health approach to cannabis legalization. Some of the public health metrics that have been identified include public safety, cannabis use trends, other substance use trends, cardiovascular and respiratory health, and mental health and cognition (Lake et al., 2018). This paper will examine five main public health metrics that have been identified in the literature. These public health outcomes will be examined in a number of different jurisdictions with a framework for both recreational and medical cannabis legalization, in order to examine strengths and weaknesses of various approaches to cannabis legalization. These public health metrics include cannabis impaired driving, alcohol impaired driving, youth cannabis use, opioid use and abuse, as well as indices of mental health and cognition. It is important to examine these metrics in order to determine the best approach to cannabis legalization with the most successful public health related outcomes in order to create better, public health focused cannabis policy in the future.

2.2. Approaches to cannabis legalization

Over the last decade, there have been numerous changes to cannabis policy worldwide. With the global market for cannabis consumption, production and sale changing at such a rapid pace, it is important to examine different approaches to cannabis legalization, as well as to consider different design options for new cannabis policy. Kilmer (2014) identifies different options available with respect to these design choices, which may have a direct impact on various public health related outcomes.

(1) The first of Kilmer's policy designs relates to the production of cannabis. Cannabis prohibition inflates the costs of producing and distributing the substance, largely due to compensating those along the supply chain for their risk of arrest, incarceration, and drug market violence (Kilmer, 2014). Cannabis legalization could lead to a deflation in costs of the substance; however, this will depend on the number of producers and types of products allowed under a legal framework. (2) The second component of a cannabis policy design involves profit. Jurisdictions could allow home production (similar to what is allowed under the Canadian legal framework), allow non-profit organizations to produce and distribute cannabis, or even impose a government monopoly on cannabis production and distribution. Profit motive will affect how jurisdictions allow for the distribution and cultivation of cannabis (Kilmer, 2014).

(3) Kilmer asserts that promotion must also be considered when designing a framework for cannabis legalization. It is important to consider how promotion will be allowed. Many cannabis companies will attempt to create and keep users through advertising. Cannabis advertising may be limited or restricted in certain ways by governments considering cannabis policy reform (Kilmer, 2014). (4) Prevention, another important policy design consideration, may include how cannabis is advertised. Literature surrounding alcohol consumption shows that there is a strong relationship between the number of retail alcohol spaces and alcohol misuse and dependence (Pacula, Kilmer, Wagenaar, Chaloupka, & Caulkins, 2014). This evidence shows that limiting the amount of retail cannabis outlets may be beneficial in preventing cannabis use and its associated harms (Kilmer, 2014).

(5) Potency is another important consideration for jurisdictions when it comes to cannabis legalization. Different cannabis products can range in potency of tetrahydrocannabinol (THC), which is primarily responsible for the intoxicating effects of cannabis. Imposing a limit on cannabis potency may allow for the black market to proliferate with respect to more potent products; however, imposing a limit on potency may protect public health and safety. THC is only one of the many cannabinoids found in the cannabis plant. Cannabidiol (CBD) is said to have far less intoxicating effects when compared with THC. Jurisdictions could impose, for example, regulations on maximum amounts of THC with minimum CBD requirements (Kilmer, 2014).

(6) Jurisdictions must also consider whether or not to regulate the purity of cannabis products, and what these limits should be. Regulators will need to consider additives, concentrates, and what kind of information to include on product labels. Jurisdictions must also decide to what extent cannabis products will need to be tested and regulated, as well as the regulation of non-cannabis ingredients (Kilmer, 2014). (7) Finally, the retail price of cannabis is a significant factor for policy makers to consider. The price of cannabis will determine what happens with respect to consumption, tax revenues, and the black market (Kilmer, 2014). While there are a number of different approaches to cannabis legalization, it is important to consider and examine different policy design approaches when implementing a legal cannabis framework. It is also important when examining the impacts of varying approaches on cannabis consumption, as well as on public health and safety, especially in jurisdictions that have already implemented a legal cannabis framework.

2.3. Cannabis legalization and public health

Despite the promise by the Canadian government to ensure that public health is the central component of recreational cannabis legalization, there is currently no universally accepted definition of a public health approach with respect to cannabis legalization. However, there seems to be a consensus on its main principles among most Canadian officials (Crepault, 2018). Specifically related to cannabis legalization, proponents of a public health approach argue that the illegal status of cannabis causes harm to individuals by exposing them to criminalization. They also argue that society is better served by legalizing and strictly regulating cannabis, that the health harms from cannabis for the average adult user are relatively minimal, and that any associated risks can be managed through the health system (Crepault, 2018). There are a number of public health metrics, which are frequently raised in legalization debates as important areas to consider in the discussion to legalize cannabis, especially for recreational purposes. These include minimizing access and use by young people, minimizing drug impaired driving, minimizing substance abuse and dependence, minimizing consumption of cannabis products with unwanted contaminants as well as minimizing concurrent use of cannabis and alcohol (Pacula et al., 2014).

Public health regulations are imperative to determine the potential costs and benefits of regulating cannabis. While millions of individuals have consumed the

substance throughout thousands of years—and many important medical benefits are associated with its consumption – there are a number of acute and long term health risks that have been identified regarding cannabis consumption (Pacula et al., 2014). A cannabis legalization approach with a focus on public health and safety provides the greatest likelihood of maximizing the benefits of cannabis consumption and minimizing its harms (Spithoff, Emerson, & Spithoff, 2015).

A public health approach is often characterized by a primary focus on population level factors and outcomes (Crepault, 2018). The policies associated with a public health approach to cannabis use are aimed at risk factors for cannabis related harms, rather than specific cannabis use itself. For example, policies such as Colorado’s approach to cannabis legalization aim to curb availability (permitted retail locations and other points of sale), accessibility (through controls on price, advertising, and promotion). These policies are aimed at addressing the assumed associated harms, not the use of the substance itself. Other policies are targeted towards the substance, such as addressing potency and quality. Most of the policies associated with a public health approach advocate for education and interventions that target specific activities and groups, such as impaired driving and youth cannabis use (Crepault, 2018). For the most part, the regulations surrounding cannabis legalization in Canada are in line with this idea of a public health approach. The Canadian government has implemented strong controls on product packaging, advertising, and price. However, many areas of regulation have been left up to the provinces and territories. Each province and territory will be responsible for determining the legal minimum age for purchase, how cannabis will be sold, and where it may be consumed (Crepault, 2018).

Lake et al., (2018) have identified five main priority indicators with 28 specific sub-categories recommended to establish the public health and safety impacts of cannabis legalization in Canada, although this framework can be applied on a global scale. The authors reviewed the relevant literature and consulted with cannabis-focused clinicians and public health scientists from across Canada (Lake et al., 2018). The public health metrics include five key subject areas: public safety, cannabis use trends, other substance use trends, cardio-respiratory health, and mental health and cognition. The authors then produced indicators or areas of interest associated with each subject area, reproduced in the table below.

Table 2. Twenty-eight indicator areas recommended to establish public health and safety impacts of cannabis legalization in Canada

| Main Priority Indicator Areas | Sub-Categories |
|-------------------------------|--|
| Public Safety | Cannabis-impaired driving Cannabis-related motor vehicle injuries and fatalities Alcohol-impaired driving Alcohol-related motor vehicle injuries and fatalities Dating and intimate partner violence Cannabis-related workplace injuries overall and across work sectors Violent and property crime |
| Cannabis Use Trends | Cannabis use initiation among youth Cannabis use disorder Unregulated cannabis product use Cannabis use among expectant and breastfeeding mothers Trends in cannabis use products and practices Cannabis-related health care utilization Cannabis-related poison centre calls Cannabis attributable burden of disease |
| Other Substance Use Trends | Medical and non-medical opioid use and use disorders Fatal and non-fatal drug overdoses Illicit stimulant use and use disorders Alcohol use and use disorders Tobacco use and use disorders |
| Cardio-Respiratory Health | Respiratory problems including COPD and lung cancer Cardiovascular problems including MI, cardiac arrest and ischemic stroke |
| Mental Health and Cognition | Psychosis and psychotic disorders Depression and anxiety Attempted and completed suicide Cognitive functioning and educational achievement among youth |

This study will focus on 5 of the main public health indicators outlined in Lake et al's framework, as well as those that have been identified in other relevant literature (see Pacula, Kilmer, Wagenaar, Chaloupka & Caulkins, 2014; Kilmer, 2017; Weiss, Howlett &

Baler, 2017) in order to analyze the public health approach employed in each of the identified jurisdictions.

The remainder of this chapter details five main public health indicators to analyze the public health approach in each of the following jurisdictions: Colorado, Washington State, Uruguay and The Netherlands. The first indicator relates to the prevalence and frequency of cannabis-impaired driving and cannabis related motor vehicle crashes and fatalities. In controlled simulated driving studies, cannabis impairment is associated with slower driving and reaction times (Lake et al., 2018). The second indicator relates to alcohol impaired driving following cannabis legalization. Increases in access to cannabis may become a substitute for excessive alcohol consumption. This has been documented among a number of medical cannabis patients. This may not always be the case however, as some research also indicates an increase in concurrent cannabis and alcohol use which may produce a greater impairment (Lake et al., 2018). The third public health indicator under examination is the prevalence and frequency of cannabis use among youth. The use of cannabis in adolescence and earlier onset of cannabis use has been associated with adverse cognitive and mental health outcomes. Some studies have shown that the prevalence of youth cannabis use has increased post-recreational cannabis legalization, while other studies have found no such relationship. Preventing the initiation and use of cannabis are priorities of the Canadian cannabis legislation, as well as that of global legalization (Lake et al., 2018).

The fourth public health metric that will be examined is the prevalence of opioid use as well as fatal and non-fatal overdoses. Cannabis is being explored as an alternative to opioid therapy among individuals with chronic pain. Problematic use of prescription opioids and cannabis has been documented among chronic pain patients in some settings, however. There are some concerns surrounding the misuse of cannabis as well as the misuse of prescription opioids. Further, many Canadian jurisdictions are facing an opioid related epidemic. This is due in part to high rates of opioid prescribing for chronic pain. There is some research that indicates that cannabis may be a viable alternative to opioids, as well as a tool to use when individuals are attempting to cease using these substances (Lake et al., 2018).

The fifth and final health indicator concerns cannabis legalization and mental health outcomes. Psychosis has been the topic of many cannabis discussions in Canada

and around the world. In some cases, cannabis use (such as high frequency, high potency, and early onset) has been linked to increases in exacerbation of symptoms for those who may have a predisposition to these disorders. However, there is no causal evidence that can be found in the literature (Lake et al., 2018). In addition, no studies have been identified that examined that changes in rates of schizophrenia or psychosis related to changes in cannabis policy (Lake et al., 2018). Given the lack of information surrounding schizophrenia or psychosis and cannabis policy specifically, mental health outcomes in jurisdictions that have legalized cannabis will be examined. This includes factors such as anxiety, depression, and rates of suicide. These public health metrics will be used to examine the strength and weaknesses of cannabis policy across jurisdictions that have framework for legal cannabis.

2.4. Cannabis impaired driving

2.4.1. Crash fatality rates after recreational marijuana legalization in Washington and Colorado

Recent analysis in Washington and Colorado has found that medical cannabis legalization has been associated with overall reductions in motor vehicle crash fatalities (see Santaella-Tenorio et al., 2017; Anderson, Hansen, & Rees, 2013). However, other studies have produced conflicting results. Aydelotte et al. (2017) conducted a study in order to evaluate the changes in motor vehicle crash fatality rates prior to, and post recreational cannabis legalization in Colorado and Washington State. The authors compared these data with motor vehicle crash fatality rates in eight similar states without legal medical or recreational cannabis. The eight states were chosen based on similarity to Colorado and Washington in terms of population size, drivers, vehicle ownership, and traffic laws. The eight states chosen were Alabama, Indiana, Kentucky, Missouri, South Carolina, Tennessee, Texas, and Wisconsin (Aydelotte et al., 2017). A differences-in-differences approach was used to compare year-over-year changes in Colorado and Washington following recreational cannabis legalization with the data from the control states. This approach allowed for the control of underlying time trends, as well as population and traffic characteristics at the state level. Post-legalization, motor vehicle crash fatality rates increased by a mean of +0.1 fatalities per billion vehicle miles traveled in Washington and Colorado. Motor vehicle crash fatality rates decreased by a

mean of -0.5 fatalities per billion vehicle miles traveled in the control states each year (Aydelotte et al., 2017).

Although the mean motor vehicle crash fatality rates in Colorado and Washington increased post recreational cannabis legalization (2012-2015), the differences in crash fatality rates in Colorado and Washington compared with the 8 control states was not statistically significant. No significant association was observed between recreational cannabis legalization in Colorado and Washington and subsequent changes in motor vehicle crash fatality rates in the first 3 years after legalization (Aydelotte et al., 2017). The fact that no significant differences in cannabis-related motor vehicle fatalities pre and post recreational cannabis legalization in Colorado and Washington was observed can definitely be considered a public health success in these two states (Aydelotte et al., 2017). However, the above study only includes data from the first three years post recreational cannabis legalization. Future studies over a longer period may produce different results, and remain warranted. In addition, it may be beneficial to compare and contrast motor vehicle fatalities in states with legal recreational cannabis, with those that allow cannabis use for medical purposes. It is important to note that although Colorado and Washington State were examined together; the law in each state differs slightly, which may have an impact on results. It would also be useful to examine non-fatal motor vehicle crashes pre and post recreational cannabis legalization in these two states in order to further examine the impact of recreational cannabis legalization and rates of cannabis impaired driving.

2.4.2. Early evidence on recreational marijuana legalization and traffic fatalities

A study conducted by Hansen et al. (2018) examined the association between recreational cannabis legalization and traffic fatalities. Data used in the study was obtained from the Fatality Analysis Reporting System (FARS) from 2000-2016. FARS is a system that represents a census of fatal traffic accidents across the United States. The main focus of the study was to examine cannabis-related traffic fatalities. This was measured as the number of fatal accidents that involved at least one driver who tested positive for cannabis (Hansen et al., 2018). Colorado and Washington State were chosen as the treated states, as they were the first two states to legalize cannabis for recreational purposes, and thus the greatest amount of traffic-related data exists for

these two jurisdictions. A comparison group was created using a synthetic control approach, which uses state-level data to create a counterfactual group that can resemble both the averages and the trajectories of key variables of treated units (the treated unit in this case being a policy change). This approach was chosen given the difficulty of finding an appropriate comparison group to serve as a control (Hansen et al., 2018).

The results of the study showed that cannabis legalization led to an increase in 0.316 cannabis-related fatalities per billion in Colorado, and an increase of 0.389 fatalities per billion in Washington State. The synthetic control estimates suggested that cannabis-related fatalities went up by more than 60% in the years following recreational legalization in Colorado and Washington, however, it is likely that only 45%-60% of the increase was caused by cannabis legalization. Despite this finding, this effect is not statistically significant (Hansen et al., 2018). Overall, the results of the study provide little support for the idea that recreational cannabis causes an increase in traffic-related fatalities. This study did not use states as control measures, but used a synthetic control approach, which could have influenced the results. Using accurate state level data as a comparison may have yielded different results. Implementation and manipulation of a synthetic control variable may also yield varying results depending on how the data were manipulated. Overall, it is clear that there is not a causal relationship between recreational cannabis legalization and an increase in traffic fatalities, and any association between the two factors were not found to be statistically significant (Hansen et al., 2018).

2.5. Alcohol impaired driving

Most research, which focuses on impaired driving and recreational cannabis legalization, focuses on the rates of cannabis impaired driving following this policy change. Little empirical evidence exists which examines the impact of cannabis legalization on rates of alcohol impaired driving. Some research supports the idea that alcohol and cannabis are substitutes, and that cannabis decriminalization may lead to a decrease in alcohol consumption. Estimates show that youths residing in states where cannabis is decriminalized consume alcohol less frequently and are less likely to engage in heavy drinking than those residing in states where cannabis possession is criminalized (see Chaloupka & Laixuthai, 1997; Saffer & Chaloupka, 1999). This

evidence may be used to hypothesize that the legalization of recreational cannabis may lead to a decrease in alcohol related motor vehicle crashes and fatalities.

2.5.1. Medical marijuana laws, traffic fatalities, and alcohol consumption

A study conducted by Anderson et al. (2013) examined the impact of medical cannabis laws and their relationship to alcohol related traffic fatalities in the United States. Data from the study was obtained from the United States Fatality Analysis Reporting System (FARS) for the period from 1990-2010 (Anderson et al., 2013). The outcome variable of the study was traffic-related fatality rates, with independent variables including mean age, unemployment, income, miles driven, seatbelt use, blood alcohol level, and legal medical cannabis. In order to determine alcohol-related traffic fatalities specifically, three outcome variables were measured including fatalities not involving alcohol, fatalities with a blood alcohol level above zero, (in order to determine crash fatalities with any alcohol involvement) and accidents where at least one driver involved in the crash had a blood alcohol level above 0.10. An ordinary least squares regression analysis was undertaken in order to examine the effect of medical cannabis legalization on traffic fatalities (Anderson et al., 2013).

The results of the study found that medical cannabis legalization is associated with a 13.2% decrease in traffic fatalities involving alcohol, and a 15.5% decrease in fatalities from accidents with at least one driver with a blood alcohol level above 0.10. Additionally, the results of the study show that traffic fatalities overall decrease by 8-11% in the first year following medical cannabis legalization. Further, the study examined the association between medical cannabis legalization and per capita alcohol sales at the state level. The results of this analysis showed that medical cannabis legalization is significantly associated with nearly a 5% decrease in the consumption of beer (the most popular beverage among 18-29 year olds) (Anderson et al., 2013). Overall, this study found that there is a negative relationship between the legalization of medical cannabis and traffic fatalities involving alcohol, which suggests that there may be a substitution effect between alcohol and cannabis. Medical cannabis legalization was found to be associated with reduced alcohol consumption, especially among young adults (Anderson et al., 2013).

The finding in this study that alcohol related traffic fatalities are negatively associated with medical cannabis legalization is definitely a benefit of legalizing the substance. Given that medical cannabis legalization seems to be associated with a decrease in alcohol related motor vehicle fatalities, it would be reasonable to hypothesize that recreational cannabis would yield similar results, especially since recreational cannabis legalization provides more adults with access to the substance than medical legalization alone. It is important to keep this in mind as a potential public health benefit of cannabis legalization in Canada. However, it is important to note some limitations involved with this hypothesis. This study focused on the effects of alcohol alone on traffic fatalities, but did not examine the impact of alcohol compared with cannabis and other drugs. Concurrent substance use is important to examine following any form of cannabis legalization. Although medical cannabis legalization is associated with a decrease in alcohol related traffic fatalities, this study examines the impact of alcohol alone, and does not specify whether traffic fatalities included individuals with alcohol and any other drugs in their system at the time of the crash. It is important to examine the impact of the concurrent use of alcohol and cannabis, as well as cannabis and other drugs which may increase following cannabis legalization.

It is also important to note that other mechanisms for the negative relationship found in this study should not be ruled out. For example, as mentioned in the study, since cannabis is typically not permitted to be consumed in public, unlike alcohol, which requires individuals to find a way home from an establishment, where alcohol may be consumed. With cannabis, this would likely not be the case, and cannabis legalization may simply reduce the amount of alcohol impaired drivers on the road (Anderson et al., 2013). Finally, it is important to keep in mind that this study focuses specifically on medical cannabis legalization, as data which focuses on recreational cannabis legalization and alcohol impaired driving is currently limited. Given that the study focuses on medical cannabis legalization, it is important to note that this may not be generalizable to jurisdictions with recreational cannabis, as recreational cannabis legalization may have effects that are more widespread.

2.6. Youth cannabis use

One of the main public health indicators for successful recreational cannabis legalization is the prevalence of youth cannabis use. Research consistently shows that

cannabis use in adolescence has harmful consequences into adulthood. Cannabis use in adolescence may leave individuals vulnerable to lasting consequences related to cognition, memory, and problem solving skills. Furthermore, cannabis use that begins in adolescence has been associated with anxiety symptoms, in addition to lower educational and economical attainment in adulthood (Rusby, Westling, Crowley, & Light, 2017). Studies of the association between medical cannabis legalization and adolescent cannabis use indicate that states with legal medical cannabis have higher rates of adolescent cannabis use. However, these rates were already higher in these states prior to medical cannabis legalization, and rates of use among youth did not change after the legislation was implemented. It is also important to note that studies which examine youth cannabis use post medical cannabis legalization typically cannot be generalized to recreational cannabis legalization (Cerda et al., 2016).

2.6.1. Association of state recreational marijuana laws with adolescent marijuana use

A study conducted by Cerda et al. (2017) attempted to examine the association between the legalization of recreational cannabis in Washington and Colorado, and self-reported adolescent cannabis use before and after legalization. The study attempted to examine whether adolescents were more likely to use cannabis in the 3 years following legalization (2013-2015) compared to the 3 years prior to legalization (2010-2012). The study was conducted using the Monitoring the Future study, which conducts annual national cross-sectional surveys of 8th, 10th and 12th graders. Data are collected in approximately 400 schools through self-administered questionnaires. The study used a multistage random sampling design with stages that included US geographic area, schools within regions of the country, and students within schools. Up to 350 students per grade per school were included, with a random selection of classrooms within schools (Cerda et al., 2017).

Difference-in-difference estimates were conducted by comparing the change in past-month cannabis use from the 3 years prior to recreational cannabis legalization, with the 3 years after recreational legalization in Washington State and Colorado. The primary outcome was to determine the individual-level binary variable: any cannabis use within the past 30 days (Cerda et al., 2017). In Washington, cannabis use among 8th and 10th graders increased by 2.0% and 4.1% respectively, post-recreational

legalization. However, past 30-day cannabis use prevalence among 8th and 10th graders in states without recreational cannabis legalization decreased by 1.3% and 0.9% respectively over the same time period. The significant decrease in cannabis use among 8th graders in non-recreational cannabis states suggests that if recreational cannabis had not been legalized in Washington, then cannabis use among 8th graders in the state would decrease rather than remain relatively stable (Cerda et al., 2017). The difference-in-difference tests indicated that the differences between Washington and non-recreational cannabis state trends were significant (Cerda et al., 2017).

The post recreational cannabis legalization increase in adolescent cannabis use in Washington State could have several explanations. The legalization of cannabis in 2012 in Washington may have reduced stigma and perceptions of risk associated with cannabis use. Further, cannabis legalization may have increased availability of the substance, thus increasing adolescent access. In addition, legalization may have also decreased the price of cannabis in the black market (Cerda et al., 2017). While this study was successful in indicating changes in adolescent cannabis use in the three years' post-recreational cannabis legalization when compared with the three years' prior, the study has some limitations. First, cannabis use frequency was determined based on self-reported data, which may result in potential response bias from respondents. Self-reported data may lead participants to respond to present a favourable image of themselves, or "fake good" to conform to socially acceptable values, or to gain social approval (van de Mortel, 2008, p. 41). In addition, the study did not include individuals who were absent from or who had dropped out of school. These individuals may represent a higher-risk subset of adolescents who may be more likely to engage in illegal substance use (Cerda et al., 2017). The information gathered is specific to Colorado and Washington States, and may not be generalized to the rest of the United States, including those that have now legalized cannabis for recreational purposes, given that law and policy in each jurisdiction is different. Further examination of cannabis use trends would be useful to examine in future years in order to continue to monitor youth cannabis use trends in these two states, as well as to examine the prevalence of youth cannabis use in other states that have since legalized recreational cannabis.

2.6.2. Medical marijuana laws and teen marijuana use

A study conducted by Anderson et al. (2015) examined the relationship between medical cannabis legislation and cannabis consumption among high school students in the United States. The study examines data from the national and state Youth Risky Behaviour Survey (YRBS) from 1993-2011. During this time, sixteen states had legalized cannabis for medical purposes. In addition, two complementary analyses were conducted using the data from the National Longitudinal Survey of Youth 1997, as well as the Treatment Episode Data Set (TEDS). TEDS contains information from drug treatment providers on individuals who reported using cannabis before being admitted for drug treatment (Anderson et al., 2015). The study examined the association between medical cannabis laws and cannabis use in the past 30 days, frequent cannabis use, cannabis use at school and whether the respondent was offered or purchased cannabis on school property. Ordinary least squares regression was undertaken in order to examine the relationship between medical cannabis laws and the outcomes mentioned (Anderson et al., 2015).

Results of the study showed that when the national and state level YRBS data were combined, the legalization of medical cannabis was associated with a 1.7% decrease in the probability of cannabis use in the past 30 days, and a 0.8% decrease in the probability of frequent use. These findings however, are not statistically significant. Despite this finding, in the national YRBS alone, medical cannabis legalization is associated with significant reductions in the probability of cannabis use when relevant covariates are included (Anderson et al., 2015). Analysis of the TEDS data showed that the relationship between cannabis use among individuals admitted to drug treatment and medical cannabis legalization (although statistically insignificant), was negative.

Overall, this study does not lend support to the argument that medical cannabis legalization leads to increased consumption of cannabis among teenagers (Anderson et al., 2015). It is important to note that this study examines all states with medical cannabis legalization between the years of interest. Each of the United States employs a slightly different approach to medical cannabis legalization, and thus outcomes may vary across states, making comparison difficult. Further, while the YRBS data runs through 2011, the TEDS data (that was used for complementary analysis) only runs through 2009, meaning that the TEDS analysis is not completely complementary to that of

YRBS, and should be taken into consideration when interpreting the results of the study (Anderson et al., 2015).

2.6.3. Legalization of recreational marijuana and community sales policy in Oregon: Impact on adolescent willingness and intent to use, parental use, and adolescent use

In the state of Oregon, the legalization of recreational cannabis was enacted in July of 2015, for those aged 21 years and older. Sales began in October of 2015. A study conducted by Rusby et al. (2017) attempted to examine the rates of cannabis use among youth in the school year immediately following legalization and the implementation of sales in the state of Oregon. The study employed a naturally occurring longitudinal quasi-experimental design that compared two cohorts of youth. The first cohort transitioned from eighth to ninth grade, and completed the 9th grade prior to recreational cannabis legalization. The second cohort transitioned from eighth to 9th grade during the time legalization of recreational cannabis was enacted, and sales of recreational cannabis began during the fall of this cohort's ninth grade year (Rusby et al., 2017). Participants were obtained from 11 middle schools from seven school districts in Oregon. Four hundred and forty-four students participated in the study. Youth were asked how many days they used cannabis in the past 30 days. Four data time points within 1 year were collected on youth cannabis use. A set of multivariate linear regression models were used to estimate the effects of legalization and sales policy on youth cannabis use from eighth to ninth grade at four time points (Rusby et al., 2017).

For youth who reported cannabis use, the average rate of use was 6.74 days out of the past 30 days. Significant increases in the rate of cannabis use occurred from spring of eighth grade to the spring of ninth grade. Youth in the legalization cohort reported significantly greater increases in cannabis use when compared with the pre-legalization cohort, with an additional 26% rate increase over the pre-legalization cohort (Rusby et al., 2017). However, recreational cannabis legalization did not appear to affect initiation of cannabis use among youth. Youth in the legalization cohort who were already using cannabis significantly increased their cannabis consumption when compared with those in the pre-legalization cohort.

Given the nature of the law surrounding cannabis in Oregon, it is unlikely that this study can be generalized to other jurisdictions. Further, this study examines youth cannabis use among one specific age group, and it would likely be important to examine rates of cannabis use following legalization among youth of different age groups rather than simply students in one grade, in order to determine if these trends are present among youth of other age groups. It will be important to continue to examine rates of cannabis use among youth in Oregon given that this study took place at one particular point in time, and further longitudinal analysis is not possible with the sample.

2.6.4. Age of first use, current marijuana use and driving after use among Canadian high school students

A study conducted by Azagba and Asbridge (2019) examined the relationship between age of first cannabis use, current cannabis use, and driving after the use of cannabis using a nationally representative sample of Canadian high school students. Data for the study were obtained from the 2014-2015 Canadian Student Tobacco, Alcohol, and Drugs Survey, which is a cross-sectional school-based survey of a sample of students in grades 6 through 12. The study restricted the sample to those individuals in grades 9 through 12 (Azagba & Asbridge, 2019). The two dependent variables of interest were past 30-day cannabis consumption, and driving after cannabis use (Azagba & Asbridge, 2019). The main independent variable of interest was age at first marijuana use. The analyses controlled for gender, grade level, cigarette and alcohol use status, level of urbanization, median household income, and region of residence. Multivariate logistic regression models were performed in order to examine the association between age at cannabis use onset, current cannabis use patterns, and driving under the influence of cannabis (Azagba & Asbridge, 2019).

Results of this study showed that of students who reported ever having used cannabis at any point in their lifetime, approximately 53% of those students reported using cannabis at least once within the past 30 days. Twenty-seven percent of those students used cannabis at least once weekly in the past 30 days. Approximately 10% of students reported driving within 2 hours of consuming cannabis in the past 30 days. The mean age of first cannabis use was 14.3 years (Azagba & Asbridge, 2019). Further, results from the multivariate logistic regression showed that age at first cannabis use was significantly associated with current cannabis use patterns. A younger age at first

cannabis use was significantly associated with a more frequent use of cannabis (at least weekly or everyday). For example, those individuals who reported using cannabis for the first time at age 13, were more likely to have used cannabis at least once per week in the last 30 days, compared to first use at age 14 (Azagba & Asbridge, 2019). Results of the study also showed that cannabis use initiation at a younger age was significantly associated with driving under the influence of cannabis. High school students in grades 9-12 who used cannabis at an earlier age had a higher likelihood of current cannabis use as well as driving after use. In addition, they were more likely to use cannabis more frequently (Azagba & Asbridge, 2019).

While this study is successful in identifying factors that are associated with the earlier onset of cannabis use among youth, it is important to note that this study does not identify a causal relationship between age at first cannabis use and subsequent patterns and behaviours of use. Additionally, it is important to be aware that this study involved the use of self-reported data, which may be vulnerable to response/reporting bias. Further, while this study examines whether or not individuals drove a car after consuming cannabis, this study did not examine drivers license data (Azagba & Asbridge, 2019). Despite these factors, this study was able to show that there is a significant association between younger age of cannabis use initiation, current patterns of cannabis use, and driving while under the influence of cannabis. This study is particularly important as it uses a large and nationally-representative sample of Canadian high school students. Given that this study was conducted using pre-legalization data, it is necessary that the Canadian government continue to focus on cannabis use prevention efforts focused on youth, potentially increasing these efforts now post-legalization.

2.7. Opioid overdose and mortality

2.7.1. Recreational cannabis legalization and opioid-related deaths in Colorado, 2000-2015

One topic of current research is whether cannabis can be used as a substitute for opioids in pain management. If this is indeed the case, a decrease in opioid related overdoses and deaths would be expected following cannabis legalization. It has been found that states with medical cannabis legalization report a 25% decrease in opioid

overdoses deaths, when compared with states without such laws (Livingston, Barnett, Delcher, & Wagenaar, 2017). However, less is known about the public health implications of recreational cannabis legalization, particularly, whether it exacerbates the current opioid epidemic. There is no current evidence that has found this to be the case. While cannabis has been found to be effective at managing chronic pain, cannabis has the potential to enhance the analgesic effect of the opioid oxycodone. Cannabis may also produce small yet significant increases in opioid abuse liability (Weiss, Boyd, Pacula, & Cooper, 2018). Additionally, studies including a large sample of chronic pain patients have found that individuals with chronic pain who use cannabis do not use lower opioid doses than those who do not use cannabis (Hall et al., 2018). A study conducted by Livingston et al. (2017) attempted to examine the association between the legalization of recreational cannabis in Colorado and opioid related deaths (Livingston et al., 2017). The study used an interrupted time-series design to evaluate the effect of Colorado's recreational cannabis legalization on opioid-related deaths. Monthly counts of opioid deaths from January 2000 through December 2015 were analyzed, covering 168 baseline months as well as the first 24 months' post-legalization. Opioid related deaths in two regionally similar states were used as co-variates. Nevada was included to allow for comparison with a state that allows for only medical cannabis, and Utah for comparison with a state where cannabis use remains illegal for all purposes at the state level (Livingston et al., 2017).

Opioid related deaths were defined as any deaths with an International Classification of Diseases, 10th Revision, code indicating opioid poisoning. Monthly opioid-related deaths were examined using the Multiple Cause of Death files available through the Centers for Disease Control and Prevention WONDER (Wide-Ranging Online Data for Epidemiologic Research) system. Analyses showed a statistically significant reduction trend in opioid-related deaths following recreational cannabis legalization in the state of Colorado (Livingston et al., 2017). When controlling for comparison state trends, opioid-related deaths decreased by approximately 0.7 deaths per month. The percent change was estimated by comparing the model-smoothed number of deaths at the end of follow-up relative to the number of deaths just prior to cannabis legalization. This resulted in an estimated 6.5% reduction in opioid related deaths in the two years following recreational cannabis legalization in Colorado (Livingston et al., 2017).

One potential cofounder and limitation to this study that is important to note is Colorado's prescription drug monitoring program registration mandate in 2014. This change required that all opioid prescribers and pharmacists register with, but not necessarily use, the prescription drug monitoring program by the end of 2014. Research shows that implementing prescription drug monitoring programs can quickly affect opioid-related deaths (Livingston et al., 2017). Although this was addressed in the study by modelling the effect of both policies simultaneously, part of the effect attributed in the study to a change in cannabis policy could also be a result of the change to Colorado's prescription drug monitoring program (Livingston et al., 2017). Given this significant decrease in opioid-deaths in Colorado post-recreational cannabis legalization, this can definitely be considered a public health success for the state following cannabis legalization. While the results of the study show a positive effect of cannabis legalization, this study provided an assessment of only the short term effects of the policy change, and continuing research is warranted in other states as recreational cannabis becomes legal in more jurisdictions within the United States and globally.

2.7.2. Cannabis Use is associated with lower rates of initiation of injection drug use among street-involved youth: A longitudinal analysis

Reddon et al. (2018) examined the association between cannabis use initiation and injection drug use among a cohort of street-involved youth from Vancouver, British Columbia. The "gateway hypothesis" is the idea that the use of certain substances promotes progression to the use of much "harder" illicit substances. This theory suggests that cannabis use facilitates the transition from licit to illicit substance use, such as the use of cocaine and heroin (Reddon et al., 2018). Given the high risk of injection-related harm among recently initiated young injection drug users, the researchers examined the impact of frequent cannabis use on rates of injection drug use initiation among a cohort of at-risk youth. The study also analyzed the effect of cannabis use on both stimulant and opioid injecting. This study took place between September 2005 and May 2015 (Reddon et al., 2018).

A total of 1215 street-involved youth enrolled in the ARYS cohort during the study period. Of these individuals, 684 (56%) were injection-naïve at the time of recruitment. By the end of the study period, 481 youth who were injection naïve at baseline

completed at least one follow up visit and thus were eligible for analysis (Reddon et al., 2018). During the study, 47.4% of participants reported at least daily cannabis use, and 24.4% reported initiating injection drug use (Reddon et al., 2018). From the date of study enrollment, the median time to injection initiation was 13 months. The proportion of baseline daily cannabis users who initiated injection drug use over the follow up period was 48.5%, compared to 49.5% among those who did not report daily cannabis use at baseline (Reddon et al., 2018). The overall results of the study indicate that periods of frequent cannabis use were associated with slower rates of injection drug use initiation. Daily cannabis use was associated with a significant decrease in the initiation of stimulant injection. No association was found between frequent cannabis use and opioid injection initiation (Reddon et al., 2018).

While Reddon et al. (2018) offer compelling evidence to refute the hypothesis that cannabis use may lead to the use of harder substances. This study involves a high-risk population of street involved youth in Vancouver, British Columbia. Based on this, this study may not be generalizable to youth in the general population who inject substances who are not street-involved or are considered “high risk”. In addition, this study uses self-reported data, which may lead to social desirability bias in reporting criminalized and stigmatized behaviours (Reddon et al., 2018). Given the disproportionate harm experienced by youth who inject drugs, and specifically, street involved youth who inject drugs, it is encouraging that cannabis use did not increase the prevalence of injection drug use. However, one disappointing aspect of this study is the lack of significant negative association between cannabis use and initiation of opioid injection. Given the opioid crisis in Canada, while it is encouraging that frequent cannabis use did not increase the initiation of the injection of opioids, it is disheartening to learn that cannabis use did not have the same effect on opioid injection initiation as it did on stimulant injection initiation. However, given the lack of generalizable data from this study, future research is needed in order to continue to examine the effects of cannabis legalization on injection drug use, and specifically, opioid injection initiation.

2.7.3. Medical cannabis patterns of use and substitution for opioids & other pharmaceutical drugs, alcohol, tobacco, and illicit substances: Results from a cross-sectional survey of authorized patients

Lucas et al., (2019) examined patient patterns of medicinal cannabis use, and the self-reported impact of cannabis on the use of prescription drugs, illicit substances, tobacco, and alcohol. In order to learn more about how patients use medical cannabis and whether medical cannabis use affects the use of other substances, a 239-question questionnaire was used to gather comprehensive information on patient demographics, patterns of cannabis use, and cannabis substitution effects (Lucas et al., 2019). The sample comprised 2032 medical cannabis patients registered with Tilray, a federally authorized medical cannabis production, distribution, and research company located in British Columbia (Lucas et al., 2019). An assessment of cannabis use included questions regarding frequency of use per day and week, as well as methods of ingestion. Further, participants were asked if they ever regularly or currently use prescription drugs, alcohol, tobacco, and illicit drugs. Participants were also asked if they had ever used cannabis as a substitute for these substances, and for which substances specifically they had substituted cannabis (Lucas et al., 2019).

A bivariate logistic regression was conducted for the substitution effects of each major drug category (Lucas et al., 2019). Sixty-nine point one percent of participants reported substituting cannabis for prescription drugs, 44.5% of participants reported substituting cannabis for alcohol, 31.1% for tobacco, and 26.6% for illicit substances. Of participants who reported substituting cannabis for prescription medications, 35.3% reported substituting cannabis for prescription opioids, the most reported out of any other prescription drugs. Of the participants who reported substituting cannabis for illicit substances, 5.7% of participants reported substituting for non-prescription opioids (Lucas et al., 2019).

This study's findings on the self-reported reduction of opioid use is extremely significant to public health in Canada given the current opioid epidemic. This study found that cannabis may reduce the use of both prescription and non-prescription opioids. Furthermore, this study suggests that regulating access to a standardized, quality-controlled source of cannabis (as Canada has done with the legalization of cannabis for recreational purposes) may provide an opportunity to maximize potential public health

benefits through a cannabis substitution effect (Lucas et al., 2019). Despite this, it is important to note the limitations of this study. Given that this study only included 2032 participants due to budgetary constraints, this may be an unrepresentative sample and thus not generalizable to the general cannabis user population. Further, this study only involves participants from a patient population registered with a medical cannabis company. These individuals may be more likely to report the positive effects of cannabis use, including a substitution effect. This study is also subject to self-report bias as well as potential recall bias (Lucas et al., 2019). Regardless of these limitations, this potential substitution effect can be considered a public health benefit of cannabis use, and ultimately of cannabis legalization.

2.8. Mental health and cognition

There is little research surrounding the legalization of recreational cannabis and the prevalence of psychosis and/or psychotic disorders specifically. Research suggests that earlier-onset cannabis use may be associated with an increased risk of earlier onset psychosis with cannabis users under the age of 16 (see Fischer et al., 2017; Marconi, Di Forti, Lewis, Murray, & Vassos, 2016; Large, Sharma, Compton, Slade, & Nielsen, 2011). Further, there is evidence of a dose-response relationship between the level of cannabis use and the risk of psychosis and schizophrenia. Use of higher potency cannabis products and cannabis use frequency has also been associated with an increased risk of psychotic symptoms (see Di Forte et al., 2009; Di Forte et al., 2015; Pierre, Gandal, & Son, 2016).

While there is some evidence examining mental health outcomes following medical cannabis legalization, little work has been done to examine mental health outcomes following recreational cannabis legalization. In a report examining the impacts of cannabis legalization in Colorado, the Colorado Department of Public Safety in October 2018 examined a number of public health outcomes following recreational legalization, one of which was suicide rate trends. Statistics showed that the overall suicide rate in Colorado has remained relatively stable since 2012, when recreational cannabis became legal in the state (Colorado Department of Public Safety, 2018). However, the prevalence of individuals who had committed suicide who tested positive for cannabis increased from 11.8% in 2012, to 22.3% in 2016. The rate of those testing positive for cannabis in Colorado in 2016, was nearly identical to the national prevalence

of 22.4%. Despite this, these toxicology tests were positive for THC, which alone, is not indicative of cannabis impairment at the time of death, and thus use of cannabis cannot be interpreted as having a causal link to suicide (Colorado Department of Public Health, 2018).

2.8.1. Does the legalization of medical marijuana increase completed suicide?

Rylander et al., (2014) examined the relationship between completed suicide and the presence of medical cannabis laws, as the relationship between medical cannabis use and suicide remains unclear. These data were collected from the Colorado Department of Public Health and Environment (CDPHE) in order to examine the total number of medical cannabis registrants, medical cannabis dispensaries per county in Colorado, mechanism of suicide death, gender, total suicide hospitalizations, unemployment, and other county-level data. For this study, the number of medical cannabis dispensaries per county was used as a proxy for medical cannabis use in that county. A mixed model Poisson regression was used to determine the association between medical cannabis use and suicide rates (Rylander, Valdez, & Nussbaum, 2014). After adjusting for unemployment, mean county elevation (given that altitude may be a risk factor for suicide), and urban versus rural county status, medical cannabis registrants per year was not a significant predictor of suicide rates. While some studies have shown positive correlations with cannabis use and suicide as well as suicidal ideation (see Pedersen, W, 2008; van Ours, Williams, Fergusson, & Horwood, 2013), it is still difficult to determine the role that cannabis truly plays with regards to suicide, as this study did not show a significant association between the two (Rylander et al., 24).

2.8.2. Cannabis use behaviours and prevalence of anxiety and depressive symptoms in a cohort of Canadian medicinal cannabis users

Turna et al. (2019) examined the prevalence of cannabis use for medicinal purposes and use for anxiety symptoms. Specifically, the study examined the prevalence of cannabis use for anxiety, psychiatric symptom severity, and cannabis use behaviours in a sample of authorized Canadian medicinal cannabis users (Turna et al., 2019). The study distributed an online survey to all authorized medical cannabis users

with Tilray, a federally authorized medical cannabis distributor in British Columbia. All respondents answered questions regarding primary illness and symptoms treated with medical cannabis. Participants who identified anxiety as one of their primary symptoms treated with cannabis were then required to complete self-reported symptom severity scales to screen for anxiety symptom severity (Turna et al., 2019). The survey included 25 anxiety-related questions. Descriptive statistics were used to describe demographics, perceived efficacy, and other various conditions. Frequencies were compared using a chi-square test, and a one way ANOVA or t-test was used to examine mean differences between groups (Turna et al., 2019).

Results of the survey showed that the self-reported severity of anxiety and depression scores were positively associated with the amount of cannabis used per day. Ninety-two percent of participants who reported anxiety symptoms reported that cannabis improved their “anxiety, worry, fears”, “irritability” (75.5%), “difficulty falling to sleep” (72.4%), “anxiety attacks” (58.8%), and “low mood” (56.9%) (Turna et al., 2019, p. 136). Among all respondents, 30.6% reported mental health as the current medical condition being treated with cannabis. The majority of participants reported that medical cannabis use improved their anxiety symptoms; however, symptom severity measures indicated ongoing anxiety symptoms, which were at least moderate in nature (Turna et al., 2019). This may suggest that although cannabis can be useful in reducing anxiety symptoms, it may not be successful in significantly decreasing symptoms.

Given concerns related to recreational cannabis legalization and potential negative mental health outcomes, this study provides some positive public health-related evidence that cannabis use can be associated with a decrease in generalized anxiety disorder symptoms. However, a limitation of this study may be the fact that the study used self-reported data, which may be vulnerable to a response bias. Further, this study may have a potentially unrepresentative sample, given that the sample chosen for the study represents registered medical cannabis users, and thus may not be representative of all cannabis users. Additionally, given that this study involves a cross-sectional design, questions involving how individuals may have developed anxiety symptoms since beginning to use either medicinal or recreational cannabis were not able to be included (Turna et al., 2019). Regardless of these limitations, the results of this study show that cannabis may be used for the treatment of a variety of medical conditions, and

the ability of cannabis to potentially reduce some mental health related symptoms for some individuals can definitely be considered a public health benefit.

2.9. Conclusion

There are many jurisdictions worldwide with a legal cannabis framework. As more and more jurisdictions amend their cannabis policies in order to allow for legal cannabis, it is important to examine the approaches taken in jurisdictions that have already made changes to their cannabis policy in order to understand the strengths and weaknesses of different approaches, prior to enacting new legislation. Some of the most important public health metrics to consider when implementing a legal framework for cannabis include cannabis impaired driving, alcohol impaired driving, youth cannabis use, opioid use and abuse, as well as mental health and cognition. For example, there have been no statistically significant changes to cannabis impaired driving following recreational cannabis legalization in Colorado and Washington State. In addition, Colorado experienced a 6% decrease in opioid-related deaths in the two years following recreational cannabis legalization. Despite these findings, more research is needed on the impacts of both medical and recreational cannabis legalization worldwide in order to truly understand the full impact of cannabis legalization and public health on a global scale.

Chapter 3.

Data and Methods

3.1. The Canadian approach

To reiterate, Canadian legislation permitting the legal possession, use, and sale of cannabis for non-medical purposes came into force on October 17, 2018. The main goals of the legislation, as outlined by Health Canada, are to protect public health and safety, and specifically, to:

1. Protect the health of young people by restricting their access to cannabis
2. Protect young people from the influence to use cannabis
3. Provide for the licit production of cannabis to reduce cannabis-related illicit activities
4. Deter illicit activities related to cannabis
5. Reduce the burden on the criminal justice system
6. Provide access to quality-controlled cannabis
7. Enhance public awareness of the health risks associated with cannabis use (Health Canada, 2018).

The *Cannabis Act* (2018) employs a deliberate public health approach. While there is no universally accepted definition of a public health approach to cannabis, public health approaches are generally characterized by a focus on population-level (as opposed to individual level) factors and outcomes (Crepault, 2018). Public health approaches utilize measures that “attempt to control the determinants of incidence, to lower the mean level of risk factors, and to shift the whole distribution of exposure in a favourable direction” (Crepault, 2018, p. 2). These include measures such as education and health promotion interventions that target activities and groups deemed to be higher risk (for example, youth cannabis use and cannabis impaired driving) (Crepault, 2018). It is important to create a framework that allows the government to evaluate the success of

meeting the objectives in the *Act*. It is necessary to evaluate the methods in place for determining the public health success of this policy change, as protecting public health and safety is at the core of this framework. This can be done by implementing concrete methods to evaluate important public health metrics relevant to cannabis legalization, including cannabis and alcohol impaired driving, youth cannabis use, opioid use and overdose, and mental health and cognition. As discussed, these methods have been outlined in relevant literature as being central to a public health approach to cannabis legalization, and are directly relevant to determining the success of the objectives outlined in the *Cannabis Act*.

3.2. Study purpose

The purpose of the current study is to evaluate the effectiveness of federally-supported public health metrics related to the legalization of recreational cannabis in Canada. This will be accomplished by examining five main public health metrics that have been identified as central to a public health approach for recreational cannabis legalization in relevant literature. These include: (1) cannabis impaired driving, (2) alcohol impaired driving, (3) rates of cannabis use among youth, (4) opioid overdose and death, and (5) mental health and cognition (Lake et al., 2018; Pacula, Kilmer, Wagenaar, Chaloupka & Caulkins, 2014; Kilmer, 2017; Weiss, Howlett & Baler, 2017). These public health metrics will be used as a reference point to examine the measures that Canada has in place in order to evaluate public health outcomes following recreational cannabis legalization. Specifically, the current study aims to identify whether the federally proposed mechanisms for measuring public health will adequately address the important public health outcomes identified in the literature surrounding cannabis legalization.

It is important to note that the current study does not attempt to examine the success or failure of cannabis legalization and public health in Canada, as data to effectively test this outcome were not available at the time of the study. Despite this, the current study is sufficiently important given that no previous studies have tested the appropriateness of the federally proposed mechanisms for evaluating cannabis-related public health outcomes following legalization. Accordingly, the current study is informed by the following research questions: (1) How equipped is Canada to accurately evaluate the public health impacts of recreational cannabis legalization? (2) What procedures, processes and policies does Canada have in place to evaluate these cannabis-related

public health metrics over time in order to determine the overall success of recreational cannabis legalization in Canada?

There are a number of reasons why it is critically important to investigate Canada's framework for examining public health outcomes following cannabis legalization. First, while Canada is the second country in the world to legalize cannabis for recreational purposes at a federal level, Canada is the first country to legalize cannabis with public health as a central component of its framework. Given this, it is important that Canada examine public health outcomes following this policy change, which has been deemed by some to be "a national, uncontrolled experiment" (Ireland, 2018, para. 3). Second, given that recreational cannabis legalization did not come into effect until October 2018, there is currently little Canadian research examining cannabis related public health outcomes post-legalization. It is important to fill this gap in the literature in order to examine the potential impacts of recreational cannabis on public health. Finally, given that there is a lack of available data examining these public health outcomes at this point in time, it is imperative to examine how well Canada is setting up to evaluate these public health metrics going forward, in order to determine how well this legislation ultimately conforms to a framework with a public health approach at its core.

3.3. Data

The current study draws from two main data sources: (1) an international sample of peer-reviewed articles on public health outcomes related to cannabis, and (2) official Canadian government data pertaining to the measurement of various public health outcomes following cannabis legalization. The data collection process for the current study involves a systematic search of data and publications, including peer-reviewed articles, empirical studies, and government-issued data following cannabis legalization, using a key word search of relevant databases. The current study aims to include all available data with information pertaining to the five previously mentioned public health outcomes. Given that there is tremendous uncertainty surrounding the overall effect of cannabis legalization on public health (Kilmer, 2017), the current study aims to canvas all data sources that examine the effects of cannabis legalization in order to evaluate whether or not Canada will have the necessary capacity to measure the public health impacts of cannabis legalization. Additionally, this study aims to specifically capture data which has been or will be implemented post-cannabis legalization in Canada. This is in

order to examine the new strategies in place to respond to the public health impacts of this policy change.

Data for the current study were collected between October 17, 2018 and April 17, 2019. October 17, 2018 marks the date that cannabis became legal to possess and use for recreational purposes in Canada, and April 17, 2019 marks six months' post-legalization. The first step in the data collection process involved an academic search of the literature that examined key public health outcomes following cannabis legalization. The data sources used in order to gather peer-reviewed articles included: Google, Google Scholar, the Simon Fraser University Library Catalogue, RAND Corporation publications, Criminal Justice Abstracts, Medline, PsychInfo, and the National Criminal Justice Reference Service. Sources used to gather official government documents included: Statistics Canada, Health Canada, the Department of Justice Canada, the Canadian Institute of Health Research, the Canadian Centre on Substance Use and Addiction, official provincial and territorial government websites, and provincial and territorial health authorities (i.e. BC Ministry of Health, Alberta Health Services, Saskatchewan Health Authority). A separate key word search was conducted for each of the five public health metrics. Each public health metric included different search criteria in order to capture as much relevant data as possible. Additionally, a broad key word search was conducted in order to further identify any relevant data that may have been missed when conducting key word searches based on each individual public health metric. A list of the key words used for each public health metric and the number of sources included for each one can be found in Table 3.

Table 3. List of the key words used for each public health metric and the number of sources included in the sample.

| Public Health Metric | Key Words Used | Number of Sources Included |
|-----------------------------|---|----------------------------|
| Cannabis impaired driving | Cannabis, cannabis impaired driving, marijuana, impaired driving, drugged driving, legalization, Canada | 2 |
| Alcohol impaired driving | Cannabis legalization, marijuana legalization, alcohol impaired driving, drunk driving, Canada | 2 |
| Youth cannabis use | Cannabis, marijuana, youth, consumption, use, legalization, Canada | 5 |
| Opioid use and mortality | Cannabis, marijuana, legalization, opioids, opioid use, opioid overdose, death, Canada | 0 |
| Mental health and cognition | Cannabis, marijuana, mental health, anxiety, depression, legalization, Canada | 1 |
| Broad/all metrics | Cannabis, marijuana, legalization, public health, Canada | 2 |

The key word searches were conducted across all disciplines in order to produce the largest and most comprehensive sample possible. While the aim of this study is to examine how well Canada is setting up to evaluate public health outcomes following cannabis legalization, American sources of data were also canvassed given the limited amount of available Canadian data following cannabis legalization. All data involving any information on each of the identified public health metrics were initially included, and categorized based on public health outcomes. The first wave of data collection included a sample of 26 peer-reviewed articles and 9 official government documents. From those sources, only data that were identified as relevant to the current study were included.

This was determined by whether or not the source contained information on any of the five public health metrics in the abstract for peer-reviewed articles, and the first paragraph for government sources. After reading each source in full, 25 of the 35 sources were then excluded due to not being relevant to the current study (i.e. sources that included relevant key words in their abstracts but were ultimately not related to any of the 5 public health metrics). Data were determined to be relevant to the study based on the methods used, the overall conclusions of each source, and whether or not the source examined any of the relevant public health outcomes post-cannabis legalization. This sampling strategy resulted in a final sample of six peer-reviewed articles and four government documents included for analysis. Two of these sources were relevant to multiple public health metrics, and were included in three of the categories. It is important to note that the Government of Canada has implemented a number of changes to statistical surveys to examine the impacts of cannabis legalization. This study discusses and examines changes to seven of these surveys. However, information pertaining to the changes to each survey comes from one source (Statistics Canada, 2018), and thus is only listed as one source for the purpose of analysis³. A list of each of the surveys discussed can be found in Appendix A. A complete list of all of the sources included for analysis for each public health metric can be found in Appendix B.⁴

3.4. Analysis

A qualitative comparative analysis of the literature was used to determine how well Canada will be able to evaluate the public health impacts of cannabis legalization, and the techniques in place to evaluate these impacts over time. The analytical technique of qualitative comparative analysis is designed to detect how certain conditions are related to outcomes of interest. This type of analysis is common in public policy research and for those examining the success of policy projects, whereby researchers typically compare a small number of policy processes and outcomes (Fischer & Maggetti, 2016). Descriptive coding was used for the purposes of this study.

³ Two additional sources were used for discussion/comparative purposes only.

⁴ It is important to note that the Government of Canada has implemented a number of changes to statistical surveys to examine the impacts of cannabis legalization. This study discusses and examines changes to seven of these surveys. However, information pertaining to the changes to each survey comes from one source (Statistics Canada, 2018), and is only listed as one source for the purpose of analysis.

Descriptive coding summarizes the basic topic of a passage of qualitative data. This type of coding is useful for studies with a wide variety of data forms such as documents, reports, empirical data, and government documents such as those included in this study (Saldana, 2013). This coding method was undertaken in order to determine the basic topic of each identified source, and the extent to which the identified sources were relevant to any of the public health metrics in Canada (Saldana, 2013). This comparative approach was used in order to determine the amount of existing data examining relevant cannabis related public health outcomes in Canada, and how specifically these metrics are being analyzed.

The current study utilizes a deductive approach. Deductive analysis involves analyzing data based on existing concepts or ideas, based on previous research with an existing theoretical framework (University of Auckland, 2019). This study uses a deductive approach in order to compare relevant literature, as data were analyzed and compared to existing concepts and themes. Specifically, it was recorded whether each of the sample items identified one or more of the five public health metrics. These data were then divided into subgroups and categorized based on each metric, in order to determine the extent to which each one of the five public health metrics is being measured. Further, this study employs an evaluative approach. Evaluation research is driven by a focus on policy-relevant questions, and aims to answer critical questions about specific social policies. Evaluation research aims to produce empirically based evidence about policies in order to determine their effectiveness (Harris, 2010). In this case, relevant sources were analyzed using an evaluative approach, in order to determine the effectiveness of the Canadian government's approach to measuring public health outcomes following cannabis legalization.

3.5. Theoretical framework

3.5.1. Social Constructionism

Social constructionism requires us to be suspicious of our assumptions about how the world appears to be, and consider that various categories within the world are constructed by people throughout the course of a myriad of social interactions (Burr, 2015). Further, the terms in which the world is understood are social artifacts, products of historical interchanges among people (Gergen, 1985). Social constructionism asks

individuals to suspend their disbelief that commonly accepted categories or understandings receive their warrant through observation, and invites one to challenge the basis of conventional knowledge (Gergen, 1985). Additionally, social constructionism focuses on how sociocultural forces tend to create our knowledge in particular ways (Burr, 2015). Historically, cannabis criminalization has stemmed from racist ideation, and the corresponding notion that cannabis is a mind-altering substance used exclusively by delinquents and criminals (Abel, 1980). Originally, the regulation and criminalization of cannabis was constructed as an issue of deviance, requiring criminalization and strict penalties for possession and use. Over time, specifically over the last decade, cannabis has come to be recognized for its therapeutic effects and related beneficial purposes. This has led to a change in the way that cannabis regulation has been constructed, shifting away from social deviance to a health related issue. As we have seen through decriminalization and legalization in numerous global jurisdictions, cannabis regulation today focuses on protecting public health. This new social construction of the substance is important to consider for the implementation of new cannabis policy, as this social construction of cannabis will influence the development of new policy and regulations for legalization.

3.5.2. Public Policy Reform

Policy processes involve a large number of individual and collective actors. These policy processes and their outcomes in the form of public policies are affected by a set of complex factors that interact and evolve over time (Fischer & Maggetti, 2016). Public policies have the potential to bring about great public health achievements. Some of the most notable public health achievements of the 19th and 20th centuries include clean water and sanitation, immunizations, and safe working conditions (Bowman et al., 2012). Implementing and evaluating public policy is extremely important, as public policies provide one of the primary means for a society to protect and improve population health. Some public policy initiatives in recent decades have proven to be highly effective, such as those surrounding tobacco control policies (Bowman et al., 2012). Given this, it is extremely important to implement and evaluate evidence-based public policy for the regulation and legalization of cannabis in Canada, in order to ensure the safety and stability of public health surrounding the use of this substance.

While public health related policy can be extremely effective, public policy should be informed by evidence. An evidence-based approach to creating healthy public policy has proven to be difficult to implement, partially due to barriers that hinder cooperation between researchers and policy makers (Bowman et al., 2012). Policy makers need to receive clear, persuasive information, which offers choice and flexibility with varying costs and benefits, and it is important that policy options reflect the political, social, and economic realities in which a given policy will be implemented (Bowman et al., 2012). However, it is clear that this increasingly complex policy environment may mean that the goal of evidence-based public policy is not attainable. Political concerns and priorities, along with the often more narrow political interests of parties, are hurdles that derail efforts to make policy more evidence-based and rational. (Parkhurst, Ettelt, & Hawkins, 2018). Based on this, it is necessary to consider the nature of political systems and how these systems influence opportunities for evidence to inform healthy policy decisions (Parkhurst et al., 2018). Further, it is extremely important to use the highest quality scientific evidence in the creation of public policy in order to create policies that will have the greatest positive impact on public health (Bowman et al., 2012).

3.6. Ethical considerations

Given the nature and scope of this project, this study is exempt from ethics review and does not require any ethical considerations. As per the Tri Council Policy Statement on Research Ethics, the policy allows exemptions from the requirements of Research Ethics Board review when the study does not involve human participants, information is legally accessible to the public and appropriately protected by law, and/or the information is publicly available and there is no reasonable expectation of privacy (Government of Canada, 2018). Regardless of the clearly stated policies, a formal exemption to research ethics review was granted by the Simon Fraser University Office of Research Ethics on October 22, 2018 for the purposes of this study.

Chapter 4.

Results

4.1. Search Results

The results of the key word search returned a substantial number of sources from each of the relevant databases; however, there were only 10 sources in total (both government sources and peer-reviewed articles), which were relevant to the current study. As outlined in Table 3, the majority of relevant sources pertained to youth cannabis use and cannabis impaired driving, with only one source discussing mental health and cognition following cannabis legalization. There were also a number of sources that covered cannabis legalization and public health generally, and were not specific to one public health metric alone. Some sources were relevant to multiple public health metrics, such as the Statistics Canada (2018) document, which outlines changes to the social statistics system in order to prepare for cannabis legalization, and to document changes following legalization. Overall, there were a limited number of both peer-reviewed and government sources of data relevant to the current study within the specified period.

4.2. Cannabis impaired driving

Deterring cannabis impaired driving is a major focus of recreational cannabis legalization. Bill C-46, (the *Transportation Act*) received Royal Assent on June 21 2018, and amended the *Criminal Code* to deal with offences related to drug-impaired driving pursuant to the *Cannabis Act*. As a result, there are a number of new procedures in place in order to evaluate the impact of recreational cannabis legalization on cannabis impaired driving. Statistics Canada has implemented changes to the social statistics system in order to evaluate the prevalence of cannabis impaired driving following legalization. Statistics Canada aims to monitor cannabis impaired driving by sub-populations such as age group and sex, and geography through the Canadian Community Health Survey (CCHS). The CCHS has been updated in order to include a module on cannabis use and driving under the influence of cannabis. Prior to cannabis legalization, the CCHS module on cannabis was optional. The updated survey includes

a non-optional cannabis module for individuals aged 12 years and older in 2019/2020 in order to measure rates of cannabis impaired driving post-legalization, as well as youth cannabis use (Statistics Canada, 2018). The Uniform Crime Reporting Survey (UCR) also includes relevant updates following cannabis legalization. Changes include questions to reflect new drug-impaired driving offences, and work is underway to determine the feasibility of collecting data concerning regulatory offences related to cannabis impaired driving at the provincial and territorial level (Statistics Canada, 2018).

A study conducted by Solomon et al., (2018) outlines the strengths and weaknesses of Canada's new *Transportation Act* (2018) following cannabis legalization. This source outlines rates of cannabis use, rates of driving after cannabis use prior to recreational legalization, and changes to drug impaired driving provisions in Canada. While this article is not an empirical study which aims to examine rates of cannabis impaired driving post-legalization, this article discusses the strengths and weaknesses of the new drug impaired driving provisions, which will have a direct impact on drug impaired driving enforcement, detection, and ultimately statistics related to cannabis impaired driving and convictions (Solomon et al., 2018). Solomon et al. (2018) argue that there are significant limitations to the new *Transportation Act*. Most significantly, it may be difficult for officers to meet the threshold requirements (the reasonable grounds to believe an individual had cannabis in his/her body) to request an oral fluid or blood sample from an individual they believe to be driving under the influence of cannabis. Second, the cost of oral fluid drug testing is substantial, and oral-fluid screening devices are under-inclusive. The threshold for testing positive on oral fluid screening devices was set at 25 ng/mL, which is significantly higher than what is now listed in the *Criminal Code*. This means that individuals with 2-24 ngs/mL of THC in oral fluid will avoid detection (Solomon et al., 2018).

Given these limitations, it is unlikely that the new drug impaired driving legislation will substantially decrease the prevalence of drug impaired driving (Solomon et al., 2018). The ability to accurately test for the prevalence of cannabis in drivers will have a direct impact on the rates of detected cannabis-impaired driving post-legalization, and possibly the true accuracy of cannabis-impaired driving rates following legalization in Canada. However, there is still a general test for impairment in the *Criminal Code*, and given this, we cannot yet be conclusive about the potential accuracy of cannabis impaired driving rates following legalization, despite the apparent weaknesses of the

new *Transportation Act*. Even more importantly, there is a significant *Charter* related issue relevant to this new drug impaired driving legislation. These changes to impaired driving legislation have the potential to engage an individual's right to life, liberty, and security of the person under section 7 of the *Charter*, and is extremely important to note in the evaluation of this new piece of legislation. Currently, none of the identified sources relevant to cannabis impaired driving have noted the potential *Charter* related issues surrounding the new drug impaired driving regulations and is an extremely important area for the government to focus in on in their evaluation of the success of new cannabis related legislation.

4.3. Alcohol impaired driving

The search results for data aiming to measure the prevalence of alcohol impaired driving following cannabis legalization in Canada were extremely limited in scope. The key word search employed did not return any academic studies examining alcohol impaired driving following cannabis legalization in any of the relevant databases within the specified period. Two government sources were identified outlining the need for measures examining impaired driving, namely, the Canadian Centre on Substance Use and Addiction, and Statistics Canada. The Canadian Centre on Substance Use has created a document outlining the National Research Agenda on the Health Impacts of Non-Medical Cannabis Use (Canadian Centre on Substance Use, 2017). This document identified six major areas as research priorities following cannabis legalization. One of these six categories includes psychomotor performance, impaired driving, detection and polysubstance use. However, this section of the document focuses solely on cannabis impaired driving as an important research priority, outlining the need to conduct reviews of existing research in areas surrounding impaired driving, including:

- “Psychomotor performance, impaired driving and detection, to determine which, if any, studies need to be updated using currently available cannabis strains;
- To determine the best way of measuring impairment associated with cannabis use;
- To determine the most appropriate approach to regulating cannabis use and driving” (Canadian Centre on Substance Use, 2017, p. 9).

Each of the research priorities listed outline the need to evaluate research areas surrounding cannabis impaired driving, with no mention of the need for changing or updated research involving rates of alcohol impaired driving following cannabis legalization, or rates of impaired driving offences that involve the concurrent use of cannabis and alcohol.

Statistics Canada released a document in October 2018 outlining the steps it is taking in order to prepare the social statistics system for cannabis legalization. One of the major steps being taken by Statistics Canada is surrounding public safety and justice, in order to monitor and assess the implications of the legislation on law enforcement, the administration of justice, and on community safety (Statistics Canada, 2018). The majority of adaptations and enhancements to surveys outlined by Statistics Canada include new cannabis related offences, and specifically, cannabis impaired driving offences. According to Statistics Canada, “several of the key indicators that are necessary for conducting research on cannabis use and its consequences for health and health care are currently well-covered by one or more of the surveys mentioned above [Canadian Health Survey on Children and Youth (CHSCY), Canadian Health Measures Survey (CHMS), Canadian Community Health Survey (CCHS)]” (Statistics Canada, 2018, p. 5). Statistics Canada already collects data pertaining to alcohol impaired driving offences via the Canadian Tobacco, Alcohol and Drugs Survey (CTADS), (soon to be renamed the Canadian Alcohol and Drugs Survey (CADS)) and the UCR (Statistics Canada, 2018). However, there is no mention of any updates to any current surveys or empirical studies surrounding alcohol impaired driving, or discussion of the importance of accurately examining rates of alcohol impaired driving (or updates to how this data will be collected) following cannabis legalization (Statistics Canada, 2018).

4.4. Youth cannabis use

One of the most widely cited purposes of the *Cannabis Act* is to “protect the health of young persons by restricting their access to cannabis”, and to “protect young persons and others from inducements to use cannabis” (*Cannabis Act*, 2018, p. 6). Sources outlining measures to capture the prevalence of cannabis use among youth following cannabis legalization were the most numerous and widely available of each of the five public health metrics. The key word search produced the most peer-reviewed

articles and government documents pertaining to youth cannabis use compared to any of the other identified public health metrics.

Statistics Canada has made a number of changes to social statistics systems and surveys to accurately determine the change and prevalence of youth cannabis use following recreational legalization in Canada. The Canadian Health Survey on Children and Youth (CHSCY) is a new cross-sectional survey to be implemented post-cannabis legalization in 2019. The sample will be drawn from a population of individuals aged 1-17 living in the provinces and territories. A module on cannabis use will be administered to those aged 12-17. Questions address frequency of cannabis use, age of first use, perceived harm resulting from use, access to cannabis and usual source of the substance (Statistics Canada, 2018). In addition to the CHSCY, the CTADS will include substantial additional content for the 2019 survey, and will be renamed the Canadian Alcohol and Drugs Survey (CADS). This survey will focus on individuals aged 15-24, and will make it possible to track trends of cannabis use in minors. This will allow for the evaluation of the success of the *Cannabis Act's* goal to prevent young people from accessing cannabis (Statistics Canada, 2018).

The new Canadian Community Health Survey (CCHS) includes a large sample size; including individuals aged 12-14, with a number of variables reflecting risk factors, socioeconomic information and both physical and mental health status (Statistics Canada, 2018). The CCHS also permits estimates at both the provincial and regional level. This will be essential to interpreting the differences and impacts of provincial and territorial distribution models. More specifically, this study will allow for insights into how various provincial distribution models pertain to the goal of preventing youth from accessing cannabis (Statistics Canada, 2018). The National Cannabis Survey (NCS) is a new cross-sectional, internet-based survey developed in order to gain a better understanding of the frequency of cannabis use, and to monitor changes in cannabis use because of recreational cannabis legalization (Statistics Canada, 2018). The target population for the NCS is non-institutionalized individuals' aged 15 years and older living in any of the 10 provinces (Statistics Canada, 2019).

A recent study published by Alexandra Zuckermann and colleagues (2019) examined cannabis use rates and trends among Canadian high school students. The study used the COMPASS survey, a large prospective cohort study of youth in Canada

between the years of 2012-2021. The study serves as a research platform for evaluating the impacts of policy change on youth health related behaviours (Zuckermann et al., 2019). The study used student data from 2012-2018 collected in Ontario and Alberta. Questions asked students about lifetime cannabis use and cannabis use frequency, age at first use, and ease of access to cannabis, in order to provide insights into pre-legalization cannabis use among Canadian youth. The results of the study show that cannabis use has been highly prevalent among youth since 2012/2013. The data from the study suggests that youth cannabis use was at its lowest point in 2015, and has been steadily increasing since. Both weekly and occasional use of cannabis have been increasing steadily since reaching their lowest point in 2015. This gradual increase corresponds to the federal discourse surrounding cannabis legalization, as the upswing identified in cannabis use among youth in this study began in 2016, the same year that the Canadian federal government discussion surrounding cannabis use began (Zuckermann et al., 2019). Additionally, during this time, public perception of cannabis use shifted to include a type of “sensible use”, which is intermittent and considered socially acceptable. These pro-cannabis messages can be associated with increased cannabis use. Most of the increase in cannabis use among youth was associated with occasional use (Zuckermann et al., 2019). These data may represent a large group of casual cannabis users who start using cannabis later and who use infrequently.

Another study conducted by Alexandra Zuckermann and colleagues (2019) examined the factors associated with cannabis use change in youth. Data for the study were collected from the annual COMPASS cohort study, a study that collects hierarchical data from Canadian high school students in grades 9-12. Students were asked how often they had used cannabis in the last 12 months, as well as a number of demographic and behavioural variables (Zuckermann et al., 2019). Students were then followed up with a year later and were categorized by rate of cannabis use. The categories included those who maintained cannabis use frequency, those who reduced their cannabis use frequency, those who ceased to use cannabis or reported non-use, and those who increased their cannabis use. The results of this study showed that students in the study either continued to use cannabis at the same rate or increased their use at follow-up (Zuckermann et al., 2019). While students differed with respect to their cannabis use at follow up, the majority of students reported equal or increased cannabis use.

A study conducted by Seema Mutti-Packer, Brianne Collyer, and David Hodgins (2018) examined the perceptions of packaging and health warning labels for cannabis among young adults. Participants were asked a series of demographic, mental health, and cannabis related questions. Participants were then randomly assigned to look at a variety of cannabis packaging and health warning labels. These included a branded package, a plain package, a branded package with a health-warning label, and a plain package with a health-warning label (Mutti-Packer et al., 2018). Respondents then rated the packages based on product appeal, perceived effectiveness of the health warning, and the level of fear elicited by the health warning. Overall, viewing packages with plain packaging and health warnings increased the levels of health knowledge across all health effects, and reduced product appeal (Mutti-Packer et al., 2018). These findings can help inform policy makers and health officials on strategies for deterring young people from using cannabis following recreational legalization.

Finally, a study conducted by Jennifer O'Loughlin and colleagues (2019) examined (before cannabis legalization) whether parental cannabis use is associated with initiation of use in adolescent offspring or with use in young-adult offspring. Data for the study were available in two longitudinal studies in Montreal. In one study, 1048 parents with children in grade 6 reported past-year cannabis use. Cannabis initiation among offspring was measured in grade 7, 9, or 11. In the second study, cannabis use data were available for 584 participants and their parents (O'Loughlin et al., 2019). The results of the study showed that grade 6 youth who had never used cannabis were 1.8 times more likely to initiate cannabis use during high school if their parents reported past year use. Further, participants with either one or two cannabis-using parents were 1.7 and 7.1 times more likely to use cannabis, respectively, when compared with participants with non-cannabis using parents (O'Loughlin et al., 2019). Overall, the results of the study found that children of cannabis users are more likely to use cannabis in adolescence. Although this study was conducted prior to cannabis legalization, it is important to be aware of how parental cannabis use increases the risk for early use and addiction in offspring, especially given the increased access to cannabis for adults following recreational cannabis legalization (O'Loughlin et al., 2019).

4.5. Opioid overdose and mortality

A number of recent studies have identified a substitution effect for cannabis among prescription and non-prescription opioid users (see Lucas et al., 2019; Reddon et al., 2018; Williams et al., 2019). However, there is currently very little data regarding opioid use and mortality following cannabis legalization in Canada given the fact that this policy change is so recent. Within the specified period, no peer-reviewed articles were identified outlining any research surrounding rates of opioid use following cannabis use. Only one relevant source from Canopy Growth Corporation was identified. This source outlined the commitment by Canopy Growth to provide \$2.5 million in funding to the University of British Columbia to investigate and research the use of cannabis in potentially treating opioid addiction. The funds will also allow researchers at the university to research the potential utility of cannabis in addressing the opioid crisis (Canopy Growth Corporation, 2019).

The document that Statistics Canada has created outlining how the social statistics system is being prepared for cannabis legalization, discusses that one of the key indicators for future research includes cannabis use and concurrent use with other substances (including tobacco, alcohol, and illicit drugs). However, it is unclear how the government actually plans to implement these measures, as there is no mention of any changes to any social surveys in order to measure these important outcomes following cannabis legalization. Furthermore, there is no specific mention of the importance of evaluating the potential cannabis substitution for opioids, or any measures in place to measure this specifically (Statistics Canada, 2018). Aside from these sources, no other relevant peer-reviewed or government sources were identified, suggesting a gap in the literature surrounding rates of opioid use following recreational cannabis legalization.

4.6. Mental health and cognition

In addition to alcohol impaired driving, the sources identified regarding mental health outcomes following cannabis legalization in Canada were very limited. One source from the Canadian Centre on Substance Use outlined in its National Research Agenda on the Health Impacts of Non-Medical Cannabis Use, the need to determine the readiness of mental health systems to respond to individuals who use cannabis and who may or may not have mental health needs. Some of the immediate next steps outlined in

the document include determining the prevalence and relationship of concurrent cannabis use and mental health disorders. This includes establishing targeted surveillance sites and mining existing data sources such as the Canadian Institute for Health Information Data, MedEffect Canada, and the Canada Vigilance Adverse Reaction Online Database (Canadian Centre on Substance Abuse, 2017).

A study conducted by Lowe, Sasiadek, Coles, and George (2019), involved a systematic search of the literature surrounding cannabis use and mental illness following cannabis legalization. Some of the mental illnesses considered in the study include schizophrenia, major depressive disorder, bipolar disorder, anxiety disorders, and posttraumatic stress disorder (Lowe et al., 2019). The study also outlines the methodological shortcomings in the current literature surrounding cannabis use and mental health. While this study does not outline statistical surveys or analyses being put in place in order to measure mental health outcomes following cannabis legalization, the collection and analysis of these data are important in order to circulate accurate information surrounding recreational cannabis use and mental health to the public. This will allow individuals to make informed choices around recreational cannabis use, and will allow policy makers to implement evidence-based policies (Lowe et al., 2019).

Table 4. List of government programs/campaigns implemented to respond to concerns regarding public health metrics

| | Cannabis impaired driving | Alcohol impaired driving | Youth cannabis use | Opioid overdose and mortality | Mental health and cognition |
|------------------------------------|--|--|--|-------------------------------|--|
| Government program/campaign | <p>Implementing new technologies to test oral fluid for prevalence of THC. These devices are currently only being used in a few Canadian jurisdictions (Department of Justice Canada, 2018).</p> <p>The new <i>Transportation Act</i> (2018).</p> <p>Public awareness campaigns such as commercials and publicly available infographics in public transit (Health Canada, 2018).</p> | <p>CTDAS & UCR will continue to examine rates of alcohol impaired driving nationwide (Statistics Canada, 2018).</p> <p>Strategic partnership with Mothers Against Drunk Driving (Health Canada, 2018).</p> | <p>Prohibiting that any cannabis packaging or label could appeal to young persons</p> <p>Restricting advertising campaigns so as to not to appeal to young persons (<i>Cannabis Act</i>, 2018).</p> <p>Disseminating evidence based information on health and safety facts about cannabis (Health Canada, 2018).</p> | Not specified. | Strategic partnership with schizophrenia society of Canada and the Centre for Addiction and Mental Health (Health Canada, 2018). |

4.7. Conclusion

In the first six months following recreational cannabis legalization in Canada, there are few measures in place to evaluate the effect of cannabis legalization on public health. With public health a central component of Canadian cannabis legalization, one would expect there to be tangible systems in place to measure the effect of this policy change on the relevant public health metrics outlined in the legislation. Some areas of public health that the Canadian government has focused on in implementing this legislation include cannabis impaired driving and “protecting the health of young persons by restricting their access to cannabis” (*Cannabis Act*, 2018, p. 6). The government has implemented some strategies to respond to/deal with concerns surrounding these public health metrics and cannabis legalization. An outline of these strategies can be found in Table 4. Currently, there is a significant constitutional issue surrounding the new impaired driving legislation, and the extent to which this legislation will allow for accurate and fair detection of drug-impaired driving is currently unclear. While the Canadian government has implemented changes to a number of surveys in order to account for cannabis legalization, the results show that there is room for significant improvement surrounding processes for measuring the effect of cannabis legalization on opioid use and abuse, as well as on mental health and cognition. Almost no information was available surrounding changes to social statistics systems to account for rates of opioid overdoses following cannabis legalization. There was also little information surrounding funding in place to implement such measures. This is extremely problematic given the opioid epidemic in Canada, especially since research has shown that cannabis can act as a substitute for opioids (Lucas et al., 2019). Overall, the results have shown that there is substantial room for improvement in implementing measures to evaluate the impact of cannabis legalization on public health.

Chapter 5.

Discussion and Conclusions

Cannabis has a long and complex history of prohibition in Canada, with tens of thousands of individuals incarcerated for cannabis-related offences. The majority of cannabis-related offences (76%) in 2016 were for simple cannabis possession (Statistics Canada, 2016). Cannabis legalization reduces the amount of individuals who could be incarcerated for cannabis offences, thus reducing the burden on the criminal justice system, and criminalizing fewer individuals. The *Cannabis Act* (2018) received Royal Assent in the House of Commons on June 21, 2018, and officially came in to force on October 17, 2018. Recreational cannabis legalization in Canada is characterized by a public health approach. The current study examined how well Canada is equipped to evaluate the public health impacts of cannabis legalization. Additionally, this study examined the procedures in place to accurately evaluate relevant public health metrics outlined in the literature, in order to determine the success of recreational cannabis legalization in Canada. The time that has passed since the end of recreational cannabis prohibition is not long enough to establish any direct effects from the policy change, however it is important to examine the methods in place to evaluate the impacts of legalization in the years to come.

5.1. Cannabis impaired driving

Cannabis impaired driving is a very important aspect of the public health framework which is central to the *Cannabis Act*. There are some new changes to social statistics systems to measure rates of cannabis impaired driving following legalization. There is also new legislation in place (the *Transportation Act*) which is complementary to the *Cannabis Act*. Changes to both the CCHS and the UCR have been made to collect data pertaining specifically to cannabis impaired driving. This is an extremely important and useful step in order to evaluate rates of cannabis impaired driving post-legalization. These changes will allow for insight into whether or not cannabis legalization has been a public health success with respect to drug impaired driving. As discussed in the study, the new regulations regarding impaired driving may make it extremely difficult to accurately test for the prevalence of cannabis among drivers, and thus will have a direct

impact on the rates of cannabis impaired driving reported in social surveys, and ultimately on the true accuracy of the rates of cannabis impaired driving following legalization. This may also influence the accuracy of any future empirical studies that aim to use this data, as well as affect the ability to deter cannabis impaired driving, as there is currently a clear lack of certainty of detection and/or punishment given these limitations. In order to obtain a true picture of the rates of cannabis impaired driving following cannabis legalization, updates will need to be made and new technologies will need to be implemented in order to accurately detect rates of cannabis impaired driving, and to obtain an accurate representation of cannabis impaired driving following legalization. A major difficulty of the new legislation is that of determining the meaning of cannabis impairment, and most importantly, how exactly to measure that impairment amongst individuals, especially given that there is currently no standard test for cannabis impairment as there is for testing for alcohol impairment.

There is still some uncertainty regarding the accuracy and constitutionality of testing for cannabis impairment on the roads. As outlined in the Solomon et al. (2018) study, the cost of testing for cannabis impairment is substantial, and it can be difficult for police officers to meet the threshold requirements to request either an oral fluid sample or blood sample from an individual who they suspect may be under the influence of cannabis. The new impaired driving legislation allows police officers to require that an individual submit to an oral fluid or blood test if the officer has “reasonable grounds to believe” that the individual is under the influence of cannabis (or other drugs) (*Transportation Act*, 2018, p.4). This poses a significant challenge to an individual's right to life, liberty and security of the person under section 7 of the *Charter*. Requiring individuals to submit to a blood test and/or oral fluid sample interferes with their bodily integrity, and thus their right to security of the person. While individuals are required to submit to a breath test when suspected of alcohol impairment, research has shown that it may be difficult to meet the requirements to require an individual to submit to these tests for cannabis impairment, and thus creates a significant issue regarding an individual's rights under the *Charter*. This has currently not been addressed in any of the identified sources, and this is an extremely important issue that seems to have been overlooked in the implementation of measures to evaluate the prevalence of cannabis impaired driving. This has the potential to influence the overall success of this cannabis related policy change. It is imperative that the government focus in on the new cannabis

impaired driving legislation and the potential *Charter* issues that it poses in future evaluation of the success of cannabis legislation.

Colorado and Washington State have pioneered recreational cannabis legalization. As two of the first North American jurisdictions to legalize cannabis for recreational purposes, there is a decent amount of information regarding the public health impacts of this policy change, specifically with regards to cannabis impaired driving. Two major studies have examined the prevalence of traffic fatalities following recreational cannabis legalization in Colorado and Washington, as discussed in the literature review. Amazingly, these two studies found that there was no significant increase in cannabis related traffic incidents and fatalities following recreational cannabis legalization, which is a significant public health success.

Preventing cannabis impaired driving is a fundamental component of the Canadian *Cannabis Act*. There have been a number of changes to social surveys in Canada in order to measure changes to cannabis impaired driving following legalization. Certainly, the changes to the CCHS and the UCR following cannabis legalization can definitely be considered steps in the right direction in order to determine the impact of cannabis impaired driving on public health. Further, cannabis impaired driving is an area that the Canadian government has implemented resources in order to measure this, when compared to other relevant public health metrics. While collecting this survey data is by all means useful, it will likely be necessary to conduct empirical analysis surrounding cannabis related traffic incidents in order to determine if there is a significant shift in cannabis related driving rates following legalization. Currently, it appears that this type of analysis is missing in Canada. In addition, there are significant *Charter* related issues surrounding testing for cannabis impairment on the roads. If Canada is to truly determine whether cannabis legalization has been a success with respect to cannabis impaired driving, more empirical research will need to be conducted in order to determine if there have been any significant changes with respect to this area of public health and safety.

5.2. Alcohol impaired driving

There is very little information pertaining to any proposed changes or updates to the social statistics system, or to research surrounding changes in rates of alcohol

impaired driving following cannabis legalization. Drunk driving is an extremely important public health concern. Research has shown that cannabis legalization may have the potential to reduce alcohol consumption and alcohol impaired driving as individuals may choose to consume cannabis instead of alcohol, thus reducing the amount of alcohol related driving accidents and fatalities. Cannabis legalization is associated with a sharp decrease in alcohol consumption, which suggests that cannabis and alcohol are substitutes (Anderson et al., 2013).

Although the Canadian social statistics system already collects data pertaining to alcohol impaired driving and traffic fatalities, it is still important to continue to collect data and implement new strategies in order to accurately identify rates of alcohol impaired driving following cannabis legalization. This will allow for the determination of whether rates of alcohol impaired driving do in fact decline in Canada following this policy change. If this is the case, then this can definitely be considered a significant public health benefit of cannabis legalization. However, more research strategies will need to be implemented in order to make this determination regarding alcohol impaired driving and public health in Canada. In the United States, states with medical cannabis legalization were examined in order to determine whether medical cannabis plays a role in reducing alcohol related traffic incidents. Specifically, statistical analyses were undertaken in order to determine this (Anderson et al., 2013). Studies such as this will be imperative to implement in Canada in order to determine whether there is a relationship between cannabis legalization and traffic fatalities incidents involving alcohol. Simply a comparison of rates of alcohol related traffic incidents pre and post legalization will not be enough to determine if there is indeed a substitution effect present in Canada. This is especially important given what has been implemented in other jurisdictions, and what has proven to be successful in determining the public health impacts of cannabis legalization on alcohol impaired driving.

5.3. Youth cannabis use

One of the most frequent concerns raised with respect to cannabis legalization is the availability of cannabis to young people. The Canadian government has vowed to keep cannabis out of the hands of youth as a major component of recreational cannabis legalization (*Cannabis Act*, 2018). Thus, it is no surprise that the majority of research and changes to the social statistics system following cannabis legalization focuses on

changes to rates of youth cannabis use. There are a number of changes and updates to surveys and statistical data, which is a very important step to evaluating the rates of cannabis use among youth. With four major changes to country-wide social surveys, and four peer-reviewed studies just six months following legalization, it is clear that focusing on rates of youth cannabis use and preventing youth from using cannabis seems to be an extremely important priority of the Canadian government with respect to cannabis legalization. This is the area with the widest array of changes and the largest investments in future cannabis related research.

However, there are still some limitations and areas for improvement with respect to research surrounding youth cannabis use. While it is promising that the new Canadian Health Survey on Children and Youth involves a module on cannabis use to be administered to young people, this module will only be administered to individuals aged 12-17. While this is indeed a step in the right direction for measuring rates of youth cannabis use, it will likely still important to measure rates of cannabis use in individuals under the age of 12. This will allow for an accurate determination of the age at which youth begin using cannabis, as well as to determine if these individuals are in fact using the substance. Further, the CHSCY is a new cross-sectional survey to be implemented post-cannabis legalization in 2019, with a sample of individuals aged 1-17. It is unclear how individuals at such a young age are to participate in the survey (for example, those aged 1, 2 or 3). This is a major limitation of this proposed survey. Additionally, both the CADS and the new NCS draws from a population of individuals aged 15 years of age and older. While these new and updated surveys will be useful to determine the rates and prevalence of cannabis use among youth following legalization, it is still necessary to examine rates of cannabis use among those under 15 years of age. Relevant literature has shown that individuals under 15 do in fact use cannabis (see Azagba & Asbridge, 2019; Cerda et al., 2017).

The findings of the packaging and health warning label study conducted by Mutti-Packer and colleagues (2018) suggests that plain packaging and health warnings have the potential to reduce product appeal and increase health knowledge among young people. This information is important given the focus on the health of youth and young adults following cannabis legalization. Knowing what packaging appeals to young people will allow policy makers to implement appropriate health warning labels and packaging for cannabis products. Being aware of packaging that appeals to young people will allow

for effective strategies for preventing youth from using cannabis in the years following cannabis legalization. Further, the finding that youth with parents who have used cannabis in the past 12 months are more likely to use cannabis is somewhat concerning. It is unclear from the findings of the study where young people who have parents who use cannabis are obtaining their own cannabis from, however, with increased availability of cannabis for adults following cannabis legalization, it will be important to continue to measure rates of youth and parental cannabis use following recreational legalization. This will allow for insight into whether or not parental cannabis use has an effect on adolescent use, and whether or not cannabis legalization increases this phenomenon.

Evidence from the COMPASS cohort studies suggests that studies on the impact of cannabis legalization on Canadian youth should consider data from several years prior to the passage of the *Cannabis Act*. Relying on 2017/2018 as the baseline year for data collection is likely to fail to identify key developments to youth cannabis use in years prior, and thus is likely to underestimate the effect of cannabis legalization on youth consumption (Zuckermann et al., 2019). Further, there is also limited value in analyzing year-to-year changes of cannabis use among youth, as there is unlikely to be major changes in rates of use from one year to the next. Analyzing changes in windows of 10 years or more is likely more appropriate, and will be more thoroughly able to show changes in prevalence of use (Zuckermann et al., 2019). The COMPASS cohort study conducted by Zuckermann et al. (2019) examining the pre-legalization patterns of cannabis use among Canadian youth found that an increase in cannabis use among youth in Canada began prior to the passage of the *Cannabis Act*. More specifically, cannabis use among youth increased when the federal discourse surrounding possible recreational cannabis legalization began (Zuckermann et al., 2019). Given that Canadian high school students were found to use cannabis at an equivalent rate or higher at the follow up period prior to cannabis legalization, this suggests that future waves of COMPASS (or other) data are going to be important to examine youth health and cannabis consumption following legalization, when compared to pre-legalization rates (Zuckermann et al., 2019).

A number of strategies have been implemented in the United States in order to determine the impact of cannabis legalization on youth consumption. A number of empirical studies have found a significant increase in cannabis use among youth following cannabis legalization (Cerdeira et al., 2017), and others have found no significant

relationship (Anderson et al., 2015). The goal of preventing youth from using cannabis is one that is central to the Cannabis Act, and currently there are a few empirical studies that attempt to examine the impacts of cannabis legalization on youth use. While there are currently no studies that have been conducted that have come to a conclusion regarding this, it is promising that the COMPASS study will continue to collect health related data on Canadian youth following recreational cannabis legalization. This will allow for an empirical analysis of the prevalence and frequency of cannabis use among Canadian youth both prior to and following cannabis legalization, similar to what has been done in a number of the United States. Empirical studies from the United States have found important results following cannabis legalization and the impacts on youth use, and implementing strategies such as those implemented in the United States will be imperative in order to determine whether the public health related goal of keeping cannabis out of the hands of youth (*Cannabis Act*, 2018) is in fact a success.

5.4. Opioid overdose and mortality

The lack of literature and changes to statistical surveys examining opioid use and mortality following recreational cannabis legalization in Canada is troubling. There is a clear gap in the proposed literature surrounding rates of opioid use following cannabis legalization. While it is promising that Canopy Growth (one of Canada's leading medical cannabis corporations) is providing millions of dollars in funding to the University of British Columbia to investigate whether cannabis could be successful in treating opioid addiction, there is a need for extensive research surrounding cannabis legalization and rates of opioid use in Canada. Currently, Canada is facing an opioid epidemic, with over 3,286 Canadians dying because of opioid overdose in the first 9 months of 2018 (Public Health Agency of Canada, 2019). A number of recent studies have identified a substitution effect for cannabis among opioid users (see Lucas et al., 2019; Reddon et al., 2018; Williams et al., 2019). Research surrounding the opioid-crisis and rates of opioid-related overdose following cannabis legalization is needed countrywide, in order to determine whether or not there is indeed a substitution effect for cannabis in Canada, and whether or not Canadian public health can benefit from cannabis legalization in this way. If rates of opioid related overdose and death are found to be decreasing following cannabis legalization, and if there is in fact a substitution effect in Canada as there is in other jurisdictions, then this can definitely be considered a significant public health

benefit of cannabis legalization. However, it remains to be seen how this is to be evaluated, as there are little, if any, measures currently in place to evaluate this.

While this study did not return any relevant sources which have been or will be implemented post-cannabis legalization which aim to examine the effect of this policy change on rates of opioid overdose and mortality in Canada, it is important to note that there are a number of sources available in Canada which currently capture rates of opioid related overdoses and deaths. These include provincial vital statistics databases; Public Health Agency of Canada surveillance systems; the Discharge Abstract Database; the Hospital Morbidity Database; the National Ambulatory Care Reporting System, and the National Treatment Indicators Project. All of these sources capture rates of opioid use and mortality in Canada. Although these sources are not new sources which have been implemented post-cannabis legalization, these sources may still be used in order to compare and contrast rates of opioid overdose and death pre-and-post legalization. If rates of opioid overdose and death are found to decline post-legalization, it will still be important to note that there may be other confounding factors which may attribute to this change, as none of the above mentioned sources aim to canvas changes in rates of opioid use or the substitution effect between cannabis and opioids post legalization specifically. While the results of this study did not produce any new sources aiming to measure such an effect, the overall conclusion that there are no relevant measures in place to measure opioid related incidents in Canada post-legalization is not absolute. Measures are still needed in Canada in order to specifically examine the prevalence of the cannabis-opioid substitution effect that has been identified in other jurisdictions with legal recreational cannabis. Stephanie Lake has outlined a comprehensive list of sources which may be used in order to canvas this.

Empirical evaluations such as those that have been conducted in other global jurisdictions (see Livingston et al., 2017; Lukas et al., 2019) will need to be conducted in order to determine the success of cannabis legalization on the opioid crisis in Canada. Conducting surveys with individuals who have a prescription for opioids to get a sense of whether this population of individuals is substituting their prescription medication for legal cannabis will be useful to get a sense of whether or not the opioid-cannabis substitution effect is prevalent in Canada. Further, comparing rates of opioid overdose deaths pre and post cannabis legalization will be useful in order to determine whether cannabis legalization has had an overarching impact on the opioid crisis. While this may

be useful, it will likely be difficult to isolate the effect cannabis has on rates of opioid use and overdose by examining rates of opioid related overdose and death given other factors that could potentially impact rates of opioid use. More research strategies will need to be implemented going forward in order to determine whether cannabis legalization can benefit public health by reducing opioid related overdose and death.

5.5. Mental health and cognition

There were a limited number of relevant sources identified surrounding the effect of cannabis legalization on mental health. There is little literature examining the impact of cannabis legalization and mental health overall. Some relevant studies have examined the impact of medical cannabis legalization on mental health. More specifically, these studies focus on suicide rather than mental health generally. Further, some studies have found an association between cannabis use and increased symptoms of generalized anxiety disorder (see Turna et al., 2019; Rylander et al., 2014). It is currently unclear how the Canadian government plans to evaluate the impact of cannabis legalization on mental health. While the Canadian Centre on Substance Use has outlined some important steps for determining the impact of cannabis legalization on mental health, it is currently not clear how exactly they plan to implement these important next steps.

Further, while the study conducted by Lowe et al., (2019) outlines the literature surrounding cannabis use and mental illness from various jurisdictions, as well as various methodological shortcomings, this study does not outline any current processes in place in order to analyze mental health outcomes following cannabis legalization in Canada. While these data are crucial to allow individuals to make informed choices surrounding recreational cannabis use, more concrete studies and practices will need to be implemented in order to truly measure the effects of cannabis legalization on this very important public health outcome. It will be important for Canada to implement strategies to examine the mental health outcomes of recreational cannabis users following legalization, as there are currently few measures in place in order to examine the impacts of cannabis legalization on mental health. Some of these strategies may include examining incidents of mental health issues among recreational cannabis users through quantitative surveys and qualitative interviews (see Turna et al., 2019). Further, it may be useful to examine the prevalence of mental health admissions to the emergency

room or hospital pre and post legalization, and to examine whether cannabis use or consumption were directly relevant to the hospital visit. This may be able to provide a better sense of the overall impact of recreational cannabis legalization on mental health.

5.6. Limitations

Although this research is necessary given the unprecedented nature of a cannabis bill with public health as a central component, this research is not without limitations. First, data for this study were collected within the first six months following cannabis legalization in Canada, using a specific key word search for each relevant public health metric. Although key words were chosen to be as comprehensive as possible, it is possible that some relevant data sources were missed. As discussed, sources which aim to canvas rates of opioid related overdose and death in Canada did not appear in the search results for this study, yet remain relevant. Thus, the sample may not be entirely representative of all of the procedures currently in place to measure the public health impacts of cannabis legalization, or of those that will be in place in the future. Second, data were only collected and analyzed if they were available on any of the listed search engines or databases, and thus any data not available online was not included in the study. Finally, the results of the study are specific to Canada given the uniqueness of the *Cannabis Act*, and the fact that there is currently no jurisdiction with a comparable cannabis policy. Therefore, the results of the study may not be generalizable to other jurisdictions who have legalized cannabis for recreational purposes at this time.

5.7. Recommendations

Recreational cannabis legalization in Canada is a new and unprecedented policy change. Future research in this area will need to continue to collect data which is relevant to each of the outlined public health metrics. In certain areas, especially pertaining to opioid overdose and mental health, more government and empirical research will need to be implemented. Specifically, strategies which aim to examine the opioid-cannabis substitution effect, as well as the impact that cannabis has on individual's mental health. Data will need to be examined in 5-10 year increments in order to make conclusions regarding cannabis legalization, as examining year-over-year

changes will likely not yield results which show significant changes. While this type of empirical and statistical research is important to continue to examine in future, it will also be important to gather data from a variety of different non-statistical sources. Cannabis consumers, including those who use both licit and illicit cannabis, medical users, and police and bylaw officers will be important to include in future research to examine the impact that cannabis legalization has had on society, and the perceived impacts of cannabis legalization. Information from these groups of individuals will not only provide insight into the impact of cannabis legalization, this will provide a different perspective on legalization and may uncover results surrounding cannabis legalization which empirical research and statistical surveys may fail to capture.

Further, gathering data from non-profit organizations, and those operating both licit and illicit dispensaries (to the extent that they continue to exist), and those who have operated an illicit dispensary which has since been shut down will allow for insight into the newly created cannabis industry, especially in places like Vancouver where the cannabis market was unlike any other jurisdiction in Canada prior to legalization. Further, examining the criminogenic impacts of cannabis legalization will be necessary to examine in order to evaluate the impacts of legalization on both public health and public safety. While it will be difficult to determine what “success” with respect to cannabis legalization really entails, it is none-the-less important to strive for and to implement strategies which have the greatest possible positive impact on public health as a whole. Canada, including provinces and municipalities will need to implement these strategies moving forward in order to achieve public health success, that is, the greatest benefits possible with respect to cannabis legalization.

While cannabis is now being framed mostly as a public health issue, it is clear that funding and research surrounding certain groups of individuals is being neglected. While cannabis is framed as an issue central to public health, it is clear that those who use opioids and those with mental health issues may still be viewed as deviants, and as such, focusing energy and funding on evaluating how cannabis legalization may benefit those who struggle with substance use, as historically, substances such as cannabis were once thought to be used only by deviants and criminals. While work needs to be done gathering research on rates of opioid use post legalization, work also needs to be done to shift towards constructing substance use as an issue which is important to public health. Moving away from treating substance abuse as a deviancy issue, will be

important to evaluate whether cannabis can benefit this important public health issue. Continuing to view substance use as a deviancy issue may also make public policy more difficult to implement, as committing to making changes and investing resources in these individuals may not align with the political agenda of many policy makers.

5.8. Conclusions

With the unprecedented legalization of recreational cannabis in Canada in October 2018, the Canadian government has made public health central to the recreational cannabis framework. Some of the main goals of cannabis legalization have been to prevent young people from using cannabis, prevent cannabis impaired driving, and to keep profits out of the hands of criminals. While there is currently no consensus on what specifically a public health approach entails, there are a number of important public health metrics that have been identified in relevant literature which are central to cannabis legalization. The goal of the current study was to examine how well equipped Canada is to accurately evaluate the public health impacts of recreational cannabis legalization, and to examine what processes and policies are in place in order to evaluate important cannabis-related public health metrics over time, in order to determine the overall success of recreational cannabis legalization in Canada. While there are a number of changes to the social statistics system in Canada in order to examine the impact of cannabis legalization, these changes focus primarily on youth cannabis use and cannabis impaired driving. While these are very important public health metrics to focus on, there are many other public health outcomes that are important to examine following cannabis legalization, outcomes which seem to be neglected at this time, given the lack of available research strategies and funding in these areas. There are limited empirical studies and government data sources which aim to examine alcohol impaired driving, opioid use and mortality and the impact of cannabis legalization on mental health.

The current study focused primarily on five public health metrics identified in relevant literature. However, cannabis legalization has the potential to impact many other areas of public health, such as violent and property crime, the consumption of black-market cannabis products, cardio-respiratory health and cannabis use among expectant and breast feeding mothers. While the results of this study did not produce a

substantial number of sources aimed at examining the public health impacts of cannabis legalization in Canada, it is important to note that this is a finding in and of itself.

Based on the results of this study, more work needs to be done in order to accurately evaluate the public health implications of recreational cannabis legalization in Canada. Although this study does not attempt to make any definitive conclusions about the success of cannabis legalization on public health, it is clear that more steps need to be taken and more research strategies will need to be implemented in order to accurately and completely evaluate the public health impacts of recreational cannabis legalization. In the first six months following cannabis legalization, it is clear that Canada is currently not as well equipped as it should be to evaluate the impacts of cannabis legalization on public health, and there are currently not enough measures in place to evaluate the success of recreational cannabis legalization over time. As cannabis regulation shifts away from a deviancy issue and moves towards health issue, it will continue to be extremely important to examine the public health impacts of legalization. If Canada is going to keep its promise to employ a framework for cannabis legalization with public health at its core, then more research strategies will need to be implemented in order to ensure that all relevant areas of public health are being examined over time. Ultimately, more research is needed in order to determine whether Canadian cannabis legalization can be considered a public health success.

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Appendix A. Surveys included in analysis

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|-------|--|
| CADS | Canadian Alcohol and Drugs Survey |
| CCHS | Canadian Community Health Survey |
| CHMS | Canadian Health Measures Survey |
| CHSCY | Canadian Health Survey on Children and Youth |
| CTADS | Canadian Tobacco and other Drugs Survey |
| NCS | National Cannabis Survey |
| UCR | Uniform Crime Report |

Appendix B. Sources included for analysis

Alcohol Impaired Driving

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Cannabis Impaired Driving

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Youth Cannabis Use

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Opioid Use

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Mental Health and Cognition

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