CANNABIS LEGALIZATION AND REGULATION

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PEI CHIEF PUBLIC HEALTH OFFICE

Executive summary

Canada's federal government has committed to legalizing cannabis for recreational use by the summer of 2018. Drivers for this policy change include high rates of use among youth, criminal records for non-violent drug offences, success of organized crime and support of public opinion. In preparation for the legalization and regulation of cannabis in PEI, the Chief Public Health Office, through the Population Health Assessment and Surveillance division, examined the health effects of cannabis use, national health statements on cannabis use, cannabis regulations in other jurisdictions, current cannabis use in PEI and potential health impacts of legalization. The information in this report informs a public health approach to cannabis legalization and regulation in PEI.

Health Effects of Cannabis Use

Cannabis products are prepared from the leaves and flowers of the cannabis plant. They are most often consumed by smoking dried cannabis flowers, although many other products and consumption methods exist such as edible products and vaping. Cannabis contains over 100 different chemical compounds, known as cannabinoids. Tetrahydrocannabinol (THC) is the principal psychoactive cannabinoid and cannabidiol (CBD) is a non-psychoactive cannabinoid known to have some medicinal benefit. Cannabis may be used recreationally to produce a desired 'high' or medicinally for symptom management in patients with HIV/AIDS, cancer, multiple sclerosis, spinal cord injuries, severe arthritis and seizures. However, cannabis is also associated with both short and long term health harms.

Short-term health harms are varied and include anxiety/panic/dysphoria, cognitive and psychomotor impairment (e.g. memory, attention, coordination), increased accident risk including motor vehicle collisions, low birthweight pregnancy and acute poisoning in children. Chronic cannabis use is associated with dependence, respiratory effects (asthma exacerbations, cough, sore throat, shortness of breath and hoarseness), impaired cardiovascular functioning, poor mental health and decreased neurocognitive functioning (e.g. learning, memory, attention). Early initiation and regular use of cannabis is associated with poor long-term social and educational outcomes. Studies of illicit substances face ethical, legal, political and practical problems and there remain significant unknowns in fully characterizing the short- and long-term health effects of cannabis use.

National Health Statements on Cannabis Legalization

The Centre for Addiction and Mental Health (CAMH) has suggested a framework for cannabis policy including a government monopoly on sales, curbing demand through pricing and limiting advertising/marketing and investing in prevention, education and treatment. The CAMH has developed Lower Risk Cannabis Use Guidelines (LRCUG) to support safer recreational use of cannabis by targeting practices linked to harmful outcomes.

Cannabis Legalization and Regulation

The Canadian Centre on Substance Use and Addiction has completed extensive work on cannabis legalization and regulation including youth focus groups, a five-part literature review and a visit to Colorado and Washington State to learn about challenges associated with legalization. The reviews confirmed health risks associated with acute cannabis use (respiratory effects), chronic cannabis use, driving under the influence of cannabis and prenatal cannabis use.

The Canadian Pediatric Society (CPS) has published regulatory recommendations for the legalization of cannabis. These recommendations include limiting marketing and availability to minors, funding prevention, education and treatment, and monitoring changes in cannabis use.

The Canadian Public Health Association (CPHA) has published recommendations for the regulation of recreational cannabis use in Canada. These guidelines aim to minimize the harms of use, establish a safe and responsible production system, design a safe and appropriate distribution system, enforce public safety and protection and ensure access to medical cannabis.

The Chief Medical Officers of Health of Canada released a position statement on cannabis policy and regulation in Canada. They recommended strategies and practices aimed at preventing cannabis-related morbidity and mortality, preventing unintended consequences of legalization, and supporting the principle of public health practice.

Cannabis Regulation Models

A thorough review of various policy options available for retail inspection and enforcement models was completed. This included options for supply systems, taxation and regulation.

A review of policies and regulations in jurisdictions with legalized recreational cannabis use is also presented, including Uruguay and the United States (Alaska, Colorado, Oregon, Washington, Vermont and District of Columbia).

Health Impact of Cannabis Legalization in Other Jurisdictions

A review of early reports of the impact or potential impact of the legalization of cannabis in other jurisdictions was conducted.

Colorado reported several changes with the legalization of recreational cannabis, including increases in impaired driving, unintentional exposures and cannabis-related emergency room visits and hospitalizations. No changes in cannabis treatment admissions were reported. There were conflicting reports of changes in cannabis use by youth and adults depending on the analysis completed. Youth felt cannabis presented fewer health risks after legalization.

The first year of legalization in Washington, D.C. showed a significant drop in cannabis arrests, however, it was too early to assess the health impacts of legalization.

Washington State reported that baked goods and desserts were the destination of 68% of the 27,000kg of cannabis legally produced in the first year. Cannabis-related poison center calls increased. Challenges with the initial implementation included the large number of producer applications received and the difficulty meeting the buffer zones around schools and parks.

In Vermont, a Health Impact Assessment (HIA) considered the possible impacts of legalization. The RAND Corporation found that cannabis consumption would likely increase 40-60% over the baseline year in the first year of legalization.

Current Cannabis Use in PEI

Cannabis use in PEI for youth and adults was analyzed. The data used for analysis is self-reported and likely represents a significant underestimation of actual use. Caution is advised in using the results of this analysis to predict the public health effects of current and future cannabis use in PEI.

Highlights from the survey of students in Grades 7-12 include:
- Students felt the risks associated with cannabis use increased with frequency of use.
- 50% of youth felt that it would be easy for them to access cannabis.
- 25% of male students and 20% of female students reported cannabis use. Cannabis use increased slightly to 33% of males and 26% of females in the last available year of data (2014-15).
- Student cannabis use increased with increasing grade-level and area median household income. Initiation of cannabis use was most common in Grades 9/10.
- Among students who used cannabis in the last year, male students were more frequent cannabis users than female students.
- Measures of student mental health, including competency, autonomy, relatedness and social responsiveness, were significantly lower among cannabis users.
- Cannabis use was most likely to be combined with tobacco use and then with other illegal drugs and alcohol.
- 21.6% of students reported being a passenger in a car driven by someone who was impaired by cannabis and 8.5% reported driving a car while impaired by cannabis.

Highlights of cannabis use in PEI for those 15 years of age and older found that:
- Cannabis use has increased from 2004 to 2015. In 2015, 38% of men and 25.4% of women reported lifetime cannabis use in PEI. Lifetime cannabis use was highest among 18 to 64 year olds (46.9% to 51.3%).
- In the last year, there were 6,200 men and 3,600 women in PEI who used cannabis. Use in the last year was highest among 18 to 24 year olds (28.7%).
- Initiation of cannabis use was most common among 12-13 year olds (approximately 35% of users), followed by 14 -15 year olds (approximately 22% of users).
- Current and former tobacco smoking was strongly associated with both lifetime and current cannabis use.

Conclusion

Cannabis use is associated with short and long-term health harms

Cannabis may be used recreationally to produce a desired 'high' or medicinally for symptom management in patients with HIV/AIDS, cancer, multiple sclerosis, spinal cord injuries, severe arthritis and seizures. However, cannabis is also associated with both short and long term health harms. Short-term health harms are varied and include anxiety/panic/dysphoria, psychomotor impairment (e.g. memory, attention, psychomotor), increased accident risk including motor vehicle collisions, low birthweight pregnancy and acute poisoning in children. Chronic cannabis use is associated with dependence, respiratory effects, impaired cardiovascular functioning, poor mental health and decreased neurocognitive functioning (e.g. learning, memory, attention). Early initiation and regular use of cannabis is associated with poor long-term social and educational outcomes. Given the early stage of cannabis legalization in other countries, there are few long-term studies that collectively assess these health and social harms at a population level. A cautious approach to legalization and regulation is therefore warranted.

Legalization may increase cannabis consumption and population health risk

Many Islanders currently use cannabis. Adult past year usage was 10.7%, which was similar to Canada, and student past year use was 25-30%, increasing with school grade. More than 50% of all initiations to cannabis use among Islanders are occurring before the age of 16. Higher prevalence groups in PEI were similar to Canada including ages 15-34, males, no university degree, never married, concurrent use of alcohol, drugs and tobacco. All data is self-reported and very likely represent an underestimate due to cannabis' illicit status.

Legalization and regulation of cannabis use is anticipated to increase consumption leading to an increase in population-level health harms. The RAND Corporation analysis found that cannabis consumption would likely increase 40-60% over the baseline year in the first year of legalization. Based on early evaluation data from Colorado's legalization of cannabis in 2014, the immediate impact of cannabis legalization in PEI may include increases in cannabis-related emergency room visits, increases in cannabis-related hospitalizations, and increases in unintentional exposures to cannabis products. There is also potential for an increase in youth cannabis use and for a decrease in youth perceptions surrounding harms associated with cannabis use. Long-term population health impacts remain unknown.

Strict regulation can mitigate population health risk

Several national public health organizations including the Centre for Addiction and Mental Health, Canadian Centre on Substance Use and Addiction, Canadian Pediatric Society, Canadian Public Health Association and Canada's Chief Medical Officers of Health have issued position statements intended to minimize health harms associated with legalized cannabis use. These statements emphasize the importance of strict government regulation including control of cannabis production and sale, establishing a minimum age of purchase, restricting advertising and marketing, curbing demand through pricing and taxation, promoting public health messaging and harm reduction (e.g. Lower Risk Cannabis Use Guidelines), and investing in surveillance

and research. The Government of Canada has recommended committing cannabis taxation revenue to support public health goals.

Finally, it is vital to recognize that currently two legalized and regulated substances, tobacco and alcohol, contribute to the majority of preventable illness, disability and death in PEI. Similar to experience with the tobacco and alcohol industries, commercialization of cannabis is anticipated to increase consumption and subsequent health harms. A government supply chain monopoly has therefore been recommended by public health organizations with some groups advocating for a non-profit distribution model. These organizations have also joined the Government of Canada's Task Force in strongly recommending against co-location of cannabis with tobacco or alcohol at retail locations. PEI's selection of a cannabis distribution and sale model will be a key aspect of cannabis regulation that will influence cannabis consumption and public health risk.

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Abbreviations

ACMPR	*Access to Cannabis for Medical Purposes Regulations*
CBD	Cannabidiol
CAMH	Centre for Addiction and Mental Health
CCSA	Canadian Centre on Substance Abuse, now the Canadian Centre on Substance Use and Addiction
CDSA	*Controlled Drugs and Substances Act*
CI	Confidence Interval
COPD	Chronic Obstructive Pulmonary Disease
CPHA	Canadian Public Health Association
CSTADS	Canadian Student Tobacco, Alcohol and Drugs Survey
CTADS	Canadian Student Tobacco, Alcohol and Drugs Survey
CTUMS	Canadian Tobacco Use Monitoring Survey
fMRI	Functional Magnetic Resonance Imaging
HIA	Health Impact Assessment
HR	Hazard Ratio
IQ	Intelligence Quotient
LRCUG	Lower Risk Cannabis Use Guidelines
PEI	Prince Edward Island
PHAS	Population Health Assessment and Surveillance
RCT	Randomized Control Trial
SES	Socio-economic status
THC	Tetrahydrocannabinol
WHO	World Health Organization
YSS	Youth Smoking Survey

Introduction

In 2015, the Government of Canada committed to legalizing, regulating and restricting cannabis access for several reasons. These reasons include the high youth cannabis use rate, the high number of criminal records related to non-violent drug offenses, high profits for organized crime from cannabis sales and recent changes in Canadian beliefs regarding criminal sanctions for cannabis possession.(1)

Currently, marijuana in Canada is a schedule II drug under the *Controlled Drugs and Substances Act* (*CDSA*). Maximum penalties for possession are six months (<30g), five years (>30g), 14 years for production and a life sentences for trafficking (> 3kg). Minimum sentences for production of cannabis vary from six months to three years depending on the number of plants.(2) Only licensed producers or testers can legally possess cannabis. Medical marijuana is legal in Canada and regulated under the *Access to Cannabis for Medical Purposes Regulations* (*ACMPR*).(3) A timeline of cannabis-related legislation in Canada is presented in Table 1.(4)

Table 1 Cannabis-related legislations in Canada, 1923-2016, adapted from (4)

Year	Event
1923	Prohibition of cannabis under *Opium and Narcotic Drug Act*
1961	Removal of minimum 6 month penalty and initiation of maximum 7 year penalty
1972	LeDain Report recommends decriminalizing cannabis - no action taken
1994	Supreme Court overturns section 462.2 (prohibition on distribution of literature and illicit drug use)
1994	Bill C-8 consolidated the *Narcotic Control Act* and *Food and Drug Act* into the *Controlled Drug and Substances Act*
1999	Clinical trial to test medical cannabis by Health Canada – 1st medical marijuana in Canada
2001	*Marijuana Medical Access Regulation* allows national access to medical marijuana
2003/2003	Special Committee on non-medical use of drugs created by House of Commons
2014	*Marijuana Medical Access Regulation* replaced by *Marijuana for Medical Purposes Regulations*
2015	Liberal Party announces plans to legalize marijuana by Spring 2017
2016	Federal Task Force on Marijuana established

Methods

1.1 Literature Review

A search of the grey literature was completed using the search term "cannabis legalization" in Google and searching the first three pages of results. In addition, the Prince Edward Island (PEI) Population Health Assessment and Surveillance (PHAS) department provided the resources already acquired on this subject area and these online resources were searched for additional resources.

A search of the grey literature was also completed for impact assessments of legalization of marijuana in Colorado, Washington State, Washington, DC, Oregon, Alaska and Uruguay using the Google search "location name AND marijuana report". The first three pages of results for each location were searched.

1.2 Data analysis

All data analysis in this report was completed using Stata 10.0/IC.(5)

1.2.1 Youth data

Data from the 2005-06 to 2012-13 Youth Smoking Surveys (YSS) and from the 2014-15 Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS) was provided by PHAS. The data analysis followed instructions in the user guide and applied the weights provided to generate estimates and proportions.

Bootstrapping was not used to generate coefficients of variation (CVs) because the bootstrapping file was unavailable. As a result, general guidance from the YSS/CSTADS for release cut-offs was modified. Data was suppressed when the number of individual survey responses contributing to the estimate was less than 30. Once the survey weights were applied to the responses, the data was also suppressed in cases where the population estimate was less than 500 people. This was due to the high variability associated with these estimates.

For frequency of cannabis use by sex, weighted sample sizes between 220 and 500 people were retained. These marginal quality estimates are associated with a high level of error. These estimates were retained because there were no underlying trends in cannabis use frequency unless the data was presented by sex.

Unknown responses (i.e. refusal, no answer and unknown answer) generally comprised a small proportion of all responses and these were generally dropped from the data presentation. Exceptions to this were for the perception of harm and ease of access questions, where unknown responses comprised a larger reportable percentage of responses and where unknown responses would be of interest to public health planners.

All estimates presented are for students from Grades 7 to 12, with the exception of the grade-level cannabis use data. For this analysis, the Grade 7 & 8 group had to be dropped due to low sample size.

Tobacco use for students was defined as having smoked at least 100 whole cigarettes in a lifetime. Alcohol use was considered consumption of a whole standard drink at any time. Illegal drug use included use of any illegal drug or use of legal substances to get high (i.e. inhaled gas, use of prescription painkillers, etc.). The specific drugs included in each YSS/CSTADS survey varied from cycle to cycle. Spice (i.e. synthetic cannabinoids) was included under other illegal drugs and was not considered as cannabis for the purposes of this analysis.

1.2.2   Adult data

Data from the annual 2004-12 Canadian Tobacco Use Monitoring Survey (CTUMS) and the 2013 and 2015 Canadian Tobacco, Alcohol and Drugs Survey (CTADS) were provided by PHAS.

Bootstrapping was not used to generate coefficients of variation (CVs) because the bootstrapping file was unavailable. As a result, general guidance from the CTUMS and CTADS for release cut-offs was modified. Data was suppressed when the number of individual survey responses contributing to the estimate was less than 30. Once the survey weights were applied to the responses, the data was also suppressed in cases where the population estimate was less than 500 people. This was due to the high variability associated with these estimates.

The association between cannabis use and other illegal drug use was considered for analysis but was not included due to the small number of users of other illegal drugs in PEI.

Health effects of cannabis use

1.3   Cannabis and related products

The Canadian Centre on Substance Use and Addiction offers the following definition of cannabis:

> *Cannabis is a greenish or brownish material consisting of the dried flowering, fruiting tops and leaves of the cannabis plant, Cannabis sativa. Hashish or cannabis resin is the dried brown or black resinous secretion of the flowering tops of the cannabis plant. The acute effects of cannabis include euphoria and relaxation, changes in perception, time distortion, deficits in attention span and memory, body tremors, and impaired motor functioning. It is a controlled substance under the Controlled Drugs and Substances Act—meaning that the acts of growing, possessing, distributing and selling cannabis are illegal. The Canadian government elected in 2015 has indicated its intention to introduce legislation in spring 2017 to legalize and regulate cannabis for non-medical use. There is also currently an exemption for those possessing cannabis for medical purposes as supported by a physician.(6)*

Cannabis contains many chemical components, including over 100 cannabinoids. These cannabinoids act on receptors in cells in the brain and body. Tetrahydrocannabinol (THC) is the primary psychoactive cannabinoid compound in cannabis. A second cannabinoid, cannabidiol (CBD) is not psychoactive and may counteract the psychoactive effects of THC. It is under investigation for potential therapeutic uses.(1)

The term cannabis refers to the whole plant and marijuana refers to the dried leaves. Throughout this report, the term cannabis is used for consistency. There are three varieties of cannabis, *C.sativa*, *C.indica* and hybrid strains.(4) Cannabis is available in a number of different products, described in Table 2.

Table 2 Available cannabis products, adapted from (4)

Cannabis product	Description	THC content	Method of use
Dried cannabis	Cured cannabis flower	<1-30%	Smoking Vaporizing Dabbing
Cannabis concentrate	Made from oil of trichrome* on marijuana flowers	20-80%	Smoking Vaporizing Dabbing
Hashish	Made from cannabis resin or fine powder produced by the trichromes	20-60%	Smoking Vaporizing
Hash oil	Made from dried cannabis material	10-50%	Smoking Vaporizing Dabbing Ingestion Topical

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Cannabis product	Description	THC content	Method of use
Butane hash oil	Oils and cannabinoids from trichromes on dried cannabis plants	60-90%	Smoking Vaporizing Dabbing
Live resin	Made from fresh-frozen plants	60-90%	Smoking Vaporizing Dabbing
Rosin	Extracted from dried flowers, trim, water hash or kief	50-70%	Smoking Vaporizing Dabbing
CO2 oil	Made of cannabis oil produced by trichromes	50-95%	Smoking Vaporizing Dabbing
Kief	Made from dried trichromes	20-60%	Smoking Vaporizing Dabbing
Water hash	Made of trichromes from dry or fresh-frozen plants	50-80%	Smoking Vaporizing Dabbing
Cannabis butter/oil	Cannabis dried buds and butter mixture	>1-30%	Preparation of edible cannabis products
Fresh cannabis	All parts of a fresh cannabis plant	Lower than when cured (contains THCA and CBDA which must be cured to release psychoactive properties)	Juicing
Tincture	Decarboxylated cannabis, mixed with a solvent (usually alcohol)	Depends on strain and production method	Topical Sublingual
Spray	Made with decarboxylated cannabis plant	A set dose of cannabis per spray (i.e. 25mg)	Topical Sublingual
Salves/Ointment/Balm	May be made from all parts of the plant	Depends on strain and production method	Topical to treatment area
Marijuana patches	Contain cannabis concentrates (i.e. terpenes, cannabinoids)	Dosage varies based on the patch	Patch

* Trichromes are hairs or spikes on the surface of a plant

1.4   Acute and chronic health risks of cannabis use

Cannabis use is associated with a variety of acute and chronic health risks (Table 3).

Table 3 Acute and chronic health risks of cannabis use, adapted from (7,8)

Acute	Chronic
• Accidental poisoning in children • Anxiety, dysphoria and panic • Cognitive impairment (reduced short-term memory, attention, reaction time and psychomotor performance) • Increased accident risk (i.e. falls, motor vehicle accidents (2-fold increase, further increased when combined alcohol use) and workplace accidents) • Reduced birthweight when used in pregnancy	• Dependence • Respiratory effects including asthma exacerbations, cough, sore throat, shortness of breath and hoarseness • Impaired cardiovascular functioning • Testicular and prostate cancer • Brain development • Long-term cognitive impairment • Mental illness (i.e. psychotic symptoms and possibly schizophrenia)

Hall (2014) completed a review of the adverse health effects of cannabis use from 1993 to 2013. The review found that driving while cannabis-impaired doubles the risk of motor vehicle accidents, with a further increase in risk when combined with alcohol. Cannabis use during pregnancy is associated with lower birthweight and may be associated with behavioural effects in those exposed *in utero*. Regular cannabis use was associated with:
- In adolescence:
  - A doubling in risk of early school-leaving
  - A doubling of the risk of cognitive impairment and psychoses in adulthood
  - Use of other illicit drugs
  - Dependence (1 in 6 users)
- In adults
  - Increased cardiovascular disease risk in middle-aged adults
  - Long-term impairments in cognitive function
  - Dependence (1 in 10 of all users)

Effects on respiratory function and respiratory cancer were unclear due to confounding with tobacco smoking.(8)

A University of Calgary review of 64 systematic reviews on the health effects of cannabis identified three levels of evidence for the harmful effect: no evidence of harm, inconclusive and evidence of harm (Figure 1).(9)
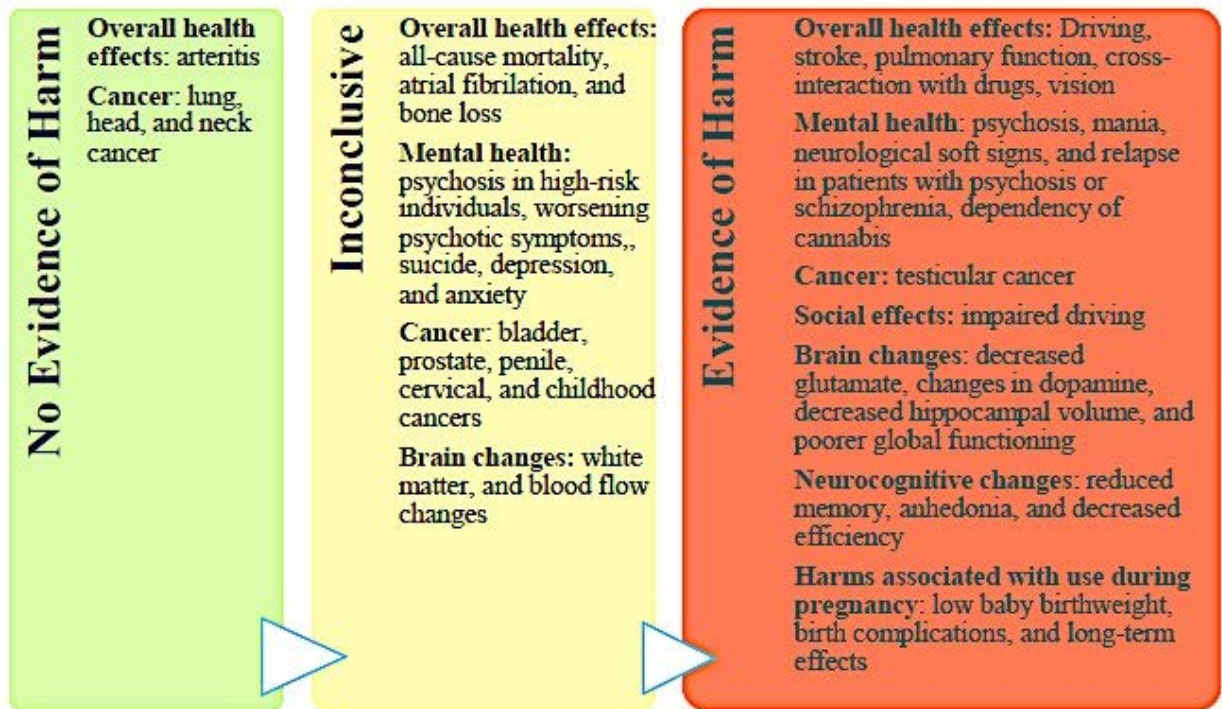
Figure 1 Overview of health effects associated with cannabis use, taken directly from (9)

Passive, or second-hand exposure to cannabis smoke can cause urine THC testing to be positive for several hours after exposure in some individuals. No strong evidence exists for the effect of second hand exposure on blood concentrations. Second-hand cannabis exposure in unventilated environments or with higher THC products produced higher blood and urine THC levels than in well-ventilated environments or with lower-THC products. Higher-THC products were also associated with more self-reported psychoactive drug effect and eye irritation. No studies on health outcomes of second-cannabis smoke exposure were found. Three studies comparing cannabis and tobacco smoke found that cannabis smoke is more likely to produce genetic mutations and is more toxic to living cells (cytotoxic) than tobacco smoke.(9)

Risk groups for negative impacts

Light or infrequent cannabis use is associated with negative outcomes in pregnant women, middle-aged men with pre-existing cardiovascular problems and in those with a personal or first-degree family history of psychosis. Heavy use is associated with negative outcomes in all users.(10)

1.5   Benefits of medical cannabis use

Benefits of medical cannabis use require further investigation but it is thought to be useful in the symptomatic treatment of cachexia (wasting syndrome), severe pain, nausea or seizures. It is also used to improve symptoms of multiple sclerosis and is under investigation as a treatment for epilepsy, particularly in children.(7) In addition, the presence of medical cannabis laws is associated with reduced unintentional opioid overdose mortality rates.(11) A summary of the

University of Calgary review of 79 Randomized Control Trials (RCTs) of medical cannabis is presented in Figure 2.(12)

Evidence of Harm	Inconclusive	Evidence of Benefit
• Depression (high dose THC)	• Appetite stimulation in HIV/AIDS infection • Anxiety disorders • Glaucoma	• Nausea and vomiting due to chemotherapy • Chronic Pain • Spasticity due to multiple sclerosis or paraplegia • Sleep disorder • Tourette syndrome
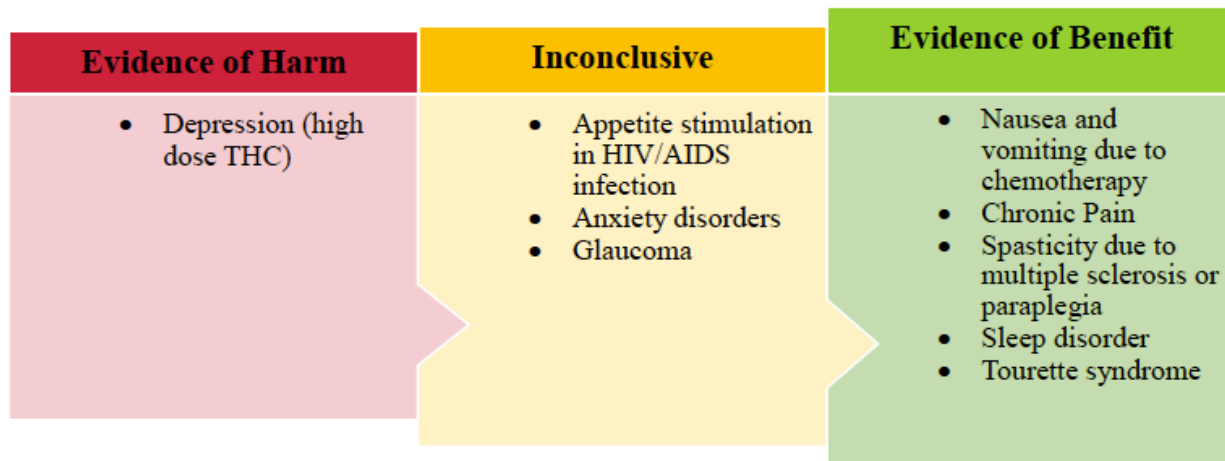
Figure 2 Summary of findings of 79 RCTs of the effectiveness of medical cannabis, taken directly from (12)

1.6 Other impacts and risks of cannabis use

Other potential outcomes of cannabis use including deciding to drop out of high school (2-fold increase) (8), labor outcomes (i.e. unemployment and decreased productivity) and criminal activity. (7)

Negative impacts of cannabis prohibition include legal costs and resources and the personal, career and neighbourhood disruption associated with having an arrest record and possible jail time. The payment of even modest fines for possession can have significant impact on low-income earners. (7)

1.7 Limitations of existing studies

The RAND corporation identified several limitations in existing studies of the effects of cannabis. Studies of illicit substances face ethical, legal, political and practical problems. Non-linear dose-response rates make it difficult to extrapolate results to doses outside the range of the study dose. Ethical barriers limit the dose, experimental setting and randomization capability of studies. Appropriate comparison groups with similar attributes are difficult to find. Many of the risk factors for cannabis use are also possible outcomes of cannabis use (i.e. propensity for substance use, delinquency, school problems, accidents and mental health problems). In addition, studies have not always considered the potency of the cannabis used, the consumption method (i.e. smoking versus other methods) and the presence of harmful contaminants.(7)

National health statements on cannabis legalization

The government of Canada solicited advice and input on five challenging issues association with the legalization of cannabis:
1. Minimizing harms of use
2. Establishing a safe and responsible production system
3. Designing an appropriate distribution system
4. Enforcing public safety and protection
5. Accessing marijuana for medical purposes (1)

This section summarizes the key Canadian position statements on the legalization of cannabis.

1.8 Centre for Addiction and Mental Health

The Centre for Addiction and Mental Health (CAMH), Canada's largest mental health and addiction teaching hospital, produced a framework for cannabis policy in October 2014. The report identified health risks of cannabis use including cognitive and psychomotor, respiratory, dependence and mental health problems. (13)

Changes to the criminalization of cannabis are needed for four reasons:
1. Prohibition does not decrease cannabis use
2. Cannabis risks and harms are less than tobacco or alcohol
3. Cannabis should be separate from illicit drug market where users can be exposed to other more harmful drugs
4. Resources spent on enforcement are better used elsewhere.(13)

The report concluded that the legalization of cannabis with strict regulations rather than decriminalization provides the opportunity to reduce the health and social harms cause by cannabis use. Decriminalization of cannabis use has several disadvantages over legalization with strict regulation including lack of quality or potency controls, difficulties for health care providers and educators in addressing use and continued illegal production. The CAMH recommendations for the regulation of cannabis sales are described in Table 4. (13)

Table 4 CAMH recommendations for a public health-focused regulatory framework, adapted from (13)

Recommendation	Rationale
1. Establish a government monopoly on sales	Control board with a social responsibility effectively controls consumption and reduces harm.
2. Set a minimum age for cannabis purchase and consumption	Penalize sales to underage individuals.
3. Limit availability	Cap retail density and limit hours of sale.
4. Curb demand through pricing	Pricing to curb demand while limiting black market sales and encourage lower-risk product use.
5. Curtail higher-risk products and formulations	Reduce consumption of higher-potency products and those targeting youth.
6. Prohibit marketing, advertising and sponsorship	Use plain packaging and warnings about risks of use.
7. Clearly display product information	Test and label products for THC and CBD content.
8. Develop a comprehensive framework to address and prevent cannabis-impaired driving	Framework to include prevention, education and enforcement.
9. Enhance access to treatment and expand treatment options	Spectrum of intervention from brief interventions for at-risk users to more intensive programs.
10. Invest in education and prevention	Use both general programs targeted to encouraging lower risk use and targeted interventions for individual at greater risk of adverse effects.

The CAMH also proposed Lower Risk Cannabis Use Guidelines (LRCUG) (10) in 2011 which have recently been updated and are being re-released in 2017. Fisher et al. (2011) created the LRCUG based on the Low-Risk Drinking Guidelines and a review of the cannabis literature. The LRCUG are designed to target practices linked to harmful outcomes of cannabis use in the scientific literature. These risk factors include early and regular cannabis use, high frequency of use, method of use, high potency products, driving in the 3 to 4 hours after cannabis use and use by high-risk groups (Table 5).

Table 5 Lower Risk Cannabis Use Guidelines, adapted from (10)

1. Abstinence is the best ways to avoid risks related to cannabis use.
2. Delay use until at least late adolescence (16+ years) or preferably early adulthood (18+ years).
3. Frequent (daily or almost daily use) should be avoided because it is associated with the most problems.
4. Those who use frequently and have difficulty controlling their use should stop using. If they are unable to stop use, they should get professional help.
5. Cannabis smokers should follow several recommendations to reduce respiratory, bronchial and cancer risks, including
   a. Avoid smoking tobacco with cannabis.
   b. Avoid deep inhalation or breath-holding
   c. Use vaporizers rather than smoking joints, blunts or water pipes
6. Limit cannabis intake to the minimum amount required to achieve the desired psychoactive effects. Avoid high potency products.
7. Do not drive for three to four hours after cannabis use, or longer if larger doses or continued impairment is involved.
8. Abstinence is recommended for:
   a. Pregnant women
   b. Middle-aged or older men with cardiovascular problems
   c. Individuals with a history of psychosis or a first-degree relative with a history of psychosis.

1.9   Canadian Centre on Substance Use and Addiction

In January 2017, the Canadian Centre on Substance Use and Addiction, formerly the Canadian Centre on Substance Abuse (CCSA), published the results of 77 youth aged 14 to 19 years of age participating in 20 focus groups across Canada examining youth perceptions of cannabis use. They found that the youth felt cannabis was less harmful than alcohol. Participants thought youth used cannabis to fit in, because it was available and acceptable and to help cope with stress. Reasons for not using included being caught by parents or police, and being labeled a drug user. Cognitive, respiratory and addictive effects were thought to be limited to frequent long-term use, although youth were unclear as to what these effects were. The effect of cannabis use on driving competence was not clear to youth and was seen as less harmful than alcohol. Participants reported limited enforcement of cannabis offenses among peers and were supportive of the greater regulation and availability of cannabis with legalization. Current prevention efforts through school assemblies or teacher lessons were unmemorable. Online media was cited as a primary source of cannabis information. Youth suggested future efforts be interactive, delivered on a small scale and present unbiased information, including harm prevention.(14) Common misconceptions of cannabis by youth are address in a 1-page infographic by the CCSA.(15)

An example of recent online multimedia education campaigns targeted to youth is the Eggs on Weed campaign. The campaign features humorous videos of eggs high on cannabis and the consequences of their actions.(16) Another recent program is the peer-led secondary school program "What's with Weed" sponsored by the Parent Action on Drug group.(17)

The CCSA published a five-part series *Clearing the Smoke on Cannabis* in 2015-2016 that examined the research surrounding cannabis use and respiratory problems, during pregnancy, while driving, the chronic effects of long-term use and use for medical purposes.(6,18–21)

The CCSA found that the literature showed that chronic cannabis use was associated with mild cognitive impairment of memory, attention, IQ and other cognitive functions. It is unclear from the research whether these impairments are reversed once chronic use ceases. In addition, there may be sex differences in the effects of chronic cannabis use. Brain development and functioning affecting cognitive and emotional processes can be impaired by chronic cannabis use. Early use and chronic use are associated with an increased risk of schizophrenia and psychotic symptoms. The increased risk of schizophrenia is higher in those with pre-existing genetic risk and in those using high THC and low CBD cannabis. Current research also indicates potential connections between chronic cannabis use and other mental health problems, including depressive disorders, anxiety and suicidal behaviours. Discussions between physicians and patients being prescribed medical cannabis should include the possible mental health impacts of chronic cannabis use and the potential for impact on daily activities (i.e. avoiding driving while impaired). The potential for mild cognitive impairment and the increased risk of mental health problems drives the CCSA recommendation for efforts focused on prevention, increasing the age of onset of use and decreasing the use of cannabis among adolescents and young adults.(6)

Cannabis is the most commonly used illicit drug during pregnancy. The CCSA reviewed the literature surrounding cannabis use in pregnancy. Prenatal exposure to cannabis had adverse effects on cognitive development, academic success and increase attention deficits, hyperactivity

and impulsivity. Adolescents with prenatal cannabis exposure may be more likely to smoke, abuse drugs and be delinquent. Advising pregnant women of the risks of prenatal cannabis exposure is recommended. Additional training in the management of cannabis use during pregnancy is needed.(21)

Cannabis use and driving has been identified as more prevalent among young drivers that drive after drinking alcohol. Cannabis use increases the risk of collisions by 50% due to cognitive and motor ability impairment. Use of cannabis increases variability in following distance, position in the lane and speed. Performance is further impaired when cannabis is combined with even a small amount of alcohol. Positive tests for cannabis are second only to alcohol for driver morbidity in collisions. The tools required to test drivers for cannabis are available to police. The CCSA recommends a combination of research, prevention, enforcement and treatment/rehabilitation to address driving while impaired.(18)

The respiratory effects of cannabis smoking include cough, wheeze, asthma exacerbations, sore throat, chest tightness, shortness of breath and hoarseness. These effects are reversible with cessation of cannabis use. Cannabis smoke contains many of the same carcinogens as tobacco smoke but research to date has not shown a strong association with lung cancer. Bullous lung disease, pneumothorax, pulmonary fibrosis, byssinosis, fungal lung infections and lung tumors have been associated with cannabis use in limited research studies. A causative link between cannabis smoking and lung cancer and other lung conditions has not yet been shown. Moderate cannabis smoking has not been shown to be a factor in COPD to date. Links between heavy cannabis smoking and COPD have not yet been studied. The CCSA recommend that health care providers be aware of the possible impact of cannabis smoking on respiratory health and provide this information and education to their patients.(20)

The final CCSA position statement is in regards to the medical use of cannabis. The need for well-designed clinical trials in Canada was identified. Cannabis has been found to be effective for nausea and vomiting, some types of pain and appetite stimulation. High doses may produce the opposite effect. Current studies are investigating the use of cannabinoid products for multiple sclerosis, psychiatric disorders, epilepsy, inflammatory disease, cancer, obesity, glaucoma and neurodegenerative disorders. Use of inhaled cannabis does not provide the same dose stability as other cannabinoid products (i.e. capsules or oral sprays). Medical use of cannabis needs to consider the potential negative effects of use. Medical cannabis use is not recommended for pregnant women, children and adolescents, and those with a history of substance abuse, heart disease and a personal or family history of psychosis. The need for further health care provider education and communication of existing clinical guidelines was recommended by the CCSA. (19)

The CCSA sent delegations to Colorado and Washington State in 2015 to learn about their experiences with the legalization of cannabis. They found that both states needed to develop a comprehensive regulatory framework and invest in effective implementation. Key lessons from regulatory development included: the need to promote consistency between medical and retail markets, respond to unexpected outcomes (i.e. overconsumption of edibles or high license demand), control formats and products, prevent commercialization and use by youth. For example, Colorado's initial regulations had a maximum THC dosage for edible products but did

not detail how the maximum THC dose would relate to the serving size. Producers started packing edibles with multiple doses in what the average person would consider a single serving (i.e. a single brownie could have up to ten doses). This format for edible products increased the risks of overconsumption, particularly given the one-hour delay between consumption and onset of psychoactive effects. Regulations were amended to specify that the packaging format for edible products must be in single dose servings of no more than 10mg of THC each. Investments in implementation included taking the time to develop framework for implementation and to develop the capacity to administer the framework, providing leadership and collaboration, investing in a public health approach, developing a clear communication approach and consistently enforcing regulations. Investing in research and rigorous ongoing data collection were also important for evaluating the implementation.(22)

1.10 Canadian Pediatric Society

In November 2016 the Canadian Pediatric Society (CPS) published a position statement on youth and cannabis. Increasing rates of unintentional cannabis ingestion by young children was an area of concern. Cannabis use during adolescence was associated with dependence and substance use problems, starting and continuing tobacco smoking, increased rates of mental illness (i.e. depression, anxiety and psychosis), reduced cognitive function and neurological development and decreased school performance and lifetime achievement. The statement expressed concern about the increased use of cannabis by adolescents with legalization.(23)

Recommendations from the statement include:
- Prohibit sales of cannabis under the legal age (i.e. 18 or 19 years)
- Limits THC concentration available for purchase by 18 to 25 year olds
- Limit marketing and availability of cannabis to minor:
  - Ensure dispensaries located away from schools
  - Prohibit self-service dispensing
  - Mandate labeling of THC concentration and ingredients
  - Mandate health warning labels
  - Mandate a marketing ban that encompasses sponsorship and social media
  - Restrict online sales to those over 18 or 19 years of age
- Include cannabis in existing tobacco smoke-free places legislation
- Fund public education to emphasize health risks of cannabis use by minors
- Develop technology for detection of cannabis use while driving and implement legislation to enforce these limits
- Increase funding for substance use and mental health promotion, prevention and treatment
- Adapt the above measures specifically for Indigenous communities
- Monitor changes in youth interactions with cannabis after legalization
- Health care providers should:
  - Communicate health risks of cannabis use to older children and parents
  - Screen children and youth for cannabis use and provide education on health risks and harms associated with use.(23)

1.11 Canadian Public Health Association

The Canadian Public Health Association (CPHA) released its position on the legalization and regulation of cannabis on August 29, 2016. The position statement contained recommendations aimed at the Government of Canada themes of minimizing the harms of use, establishing a safe and responsible production system, designing an appropriate distribution system, enforcing public safety and protection and accessing cannabis for medical purposes. The development of a consistent pan-Canadian approach to the legalization and regulation of cannabis that integrated all provincial, territorial and federal concerns was recommended.

Table 6 lists the other recommendations of the position statement.(24)

Table 6 CPHA recommendations for the regulation of cannabis in Canada, adapted from (24)

Themes	Domain	Recommendation
Minimizing harms of use	Minimum age for legal purchase	- Minimum age should be 19 in all provinces and territories, regardless of the minimum age for alcohol and tobacco.
	Advertising and marketing restrictions	- Prohibit advertising and sponsorships of cannabis-containing products. - Develop and implement targeted health promotion and harm reduction messages prior to initial product sale. - Prohibit cannabis-containing products attractive to minors (i.e. THC-infused candy or drinks).
	Taxation and pricing	- Establish taxation rate(s) based on price elasticity analysis. - Direct tax revenues back into programs and activities to manage the legalization and regulation of cannabis. - A variable taxation rate system should be established, where higher taxes apply to higher THC-containing products.
	Restrictions on cannabis products	- A maximum THC concentration of 15% should be permitted for usable cannabis products. - Products with a THC concentration above 15% should be reserved therapeutic use.
	Restrictions on quantities for personal possession	- A maximum purchase amount for personal consumption of 28g per day of dried usable product and equivalent maximum purchase amount for other products based on THC concentration.
	Retail locations	- The e-commerce model should be maintained and expanded to support recreational use. - If storefront retail sales are permitted, detail recommendations should be made based on the criteria developed by Washington State, limiting distance between retail operations and areas frequented by minors. - Establish limitations on outdoor signage and promotional activities.
Establishing a safe and responsible production system	Production models and good manufacturing practice	- Regulations and standards for medical cannabis usage should be maintained for recreational cannabis production. - Home production should be permitted under strict controls, including prohibition of high THC-products and on provision of cannabis to children.
	Product packaging and labeling	- All cannabis-containing products should have plain-package regulations applied. - All cannabis-containing products should have evidence-informed health warnings, contraindications, harm reduction messages and support service access information.

Themes	Domain	Recommendation
Designing an appropriate distribution system	Distribution system	- The e-commerce model should be maintained and expanded to support recreational use. - Market information should be used to develop dedicated government-run cannabis retail centres with trained staff to enforce sales limitations and provide further support information. - Retail cannabis sales operations should not co-exist with existing pharmacy or alcohol sales locations.
Enforcing public safety and protection	Managing the illicit market	- Use a portion of cannabis tax revenue to support law enforcement of illegal growth, production and sale of cannabis.
	Impaired driving	- Implement standard roadside sobriety tests, tools and devices in all Canadian jurisdictions. - Use a portion of cannabis tax revenue to support law enforcement in receiving training to assess and prosecute those driving under the influence of cannabis. - Use a portion of cannabis tax revenue to develop health promotion campaigns to inform Canadians of the risks of cannabis use.
	Consumption in public spaces	- All relevant regulations regarding smoke-free bylaws and workplace use of tobacco and alcohol consumption should be amended to include cannabis.
Accessing cannabis for medical purposes	Medical access	- Recreational and medical cannabis systems should be amalgamated so products required by medical users can be accessed through the recreational system. - Higher THC products and access to cannabis by minors should be permitted under the recommendation of physicians. Authorized manufacturers should produce high THC products. - All cannabis-containing products should be subject to the same taxes.

1.12 Chief Medical Officers of Health of Canada & Urban Public Health Network

The Chief Medical Officers of Health for the Canadian provinces (except Québec), territories and largest urban areas released a position statement on cannabis policy and regulation in Canada on September 26, 2016. A study of attributable fractions estimated that most of the additional morbidity and mortality burden related to cannabis use in Canada is related to MVCs and substance use disorders, with a very limited contribution by new onset schizophrenia and lung cancer.(26) Limited evidence is available for the creation of evidence-based policies and regulations surrounding legal recreational cannabis use. Policies shown to be useful for tobacco and alcohol may be transferable to cannabis.(25)

Policy development should be guided by:
1. Keep health promotion and protection a priority. Revenue generation for government is secondary. This can be accomplished by supporting individual autonomy, ensuring accountability for actions that harm others, supporting access for medical reasons, reducing stigma and discrimination for use and ensuring treatment availability.
2. Start with most restrictive regulations, and then loosen as needed.
3. Base policies on existing evidence.
4. Consider determinants of health, equity and the need to support community development to address likely unequal distribution of cannabis-related harms.
5. Ensure sufficient funding and human resources for regulatory, public health and safety measures.
6. Evaluate and adjust policies as needed.(25)

The position statement proposed both policy objectives (Table 7) and strategies and practices (Table 8) for the regulation of recreational cannabis.

Table 7 Public health objectives of cannabis regulation, adapted from (25)

Objective	Components	Priorities
Prevent cannabis-related morbidity and mortality	• Risky use (heavy/frequent use, use with alcohol, impaired driving and concentrates) • Harmful routes of consumption (smoking +/- tobacco and frequent/heavy use) • Child and youth developmental harm and school problems • Poisoning and injury (including accurate descriptions of product contents +/- pesticides) • Worsening health inequality (i.e. outcomes disproportionately affect youth, those with mental health problems, pregnant women, low SES communities) • Cannabis workplace problems • Black market harms (i.e. injuries, sexual exploitation)	• Limit demand, availability and access • Increase awareness and knowledge about cannabis • Prevent/delay onset of use by youth • Prevent normalization without stigmatization • Ensure least harmful products are most accessible
Prevent unintended consequences of legalization	• Stigma/discrimination related to problematic use • Equity impacts • Effective evaluation	• Regulate production and distribution using business models and taxation to create jobs, and distribute wealth fairly • Evaluate impacts using specific measures, targets, with baseline data and ongoing data collection and reporting

Table 8 Public health strategies and practices for cannabis policy and regulation, adapted from (25)

Approach	Strategies and practices
Health protection	• Regulate entire supply chain • Public health and safety goals and objectives mandate for control structure • Use government monopoly and supply management system to control supply • Allow cannabis growing in small amounts only for personal use • Raw product sales should only be in bulk • Ensure concentrations, proper use and adverse effects through labeling and other methods to inform users • Apply rigorous quality control to processed and concentrated products • Retail outlets and sales points should be non-promoting • Minimum age for sale/purchase • Taxation and price controls should limit consumption and limit illegal markets • Do not allow co-sale with alcohol or tobacco • Ban public smoking but consider limited on-site consumption model to reduce visible use in public spaces • Support research into cannabis impaired driving measures • Do not permit practices promoting cannabis use (i.e. advertising, sponsorship, etc.)
Health promotion	• Support increased health and personal control in areas affected by changes in cannabis policy • Attend to determinants of child and youth health
Harm-reduction	• Develop and promote lower risk cannabis use guidelines
Injury and disease prevention	• Prevent injuries, impaired driving and smoking-related diseases
Emergency preparedness and response	• Prepare for potential hazards such as the need to recall products
Services for problematic use	• Expect and prepare for an increase in demand and need for strengthened substance use and mental health treatment services
Services for therapeutic use	• Ensure providers and patients have access to accurate information about indications, effects, risks and harm reduction
Health assessment, surveillance and research	• Ensure sufficient resources for monitoring and research • Implement national surveillance system to detect and correct problems effectively

Cannabis regulation models

1.13 Policy options for cannabis regulation

The RAND Corporation prepared a report for the Vermont State Legislature in 2015 that examined the legal basis for legalization of cannabis in the state, current cannabis use and enforcement costs in Vermont, the scientific literature on the effects and benefits of cannabis use. The report then considers supply options, shaping consumption through taxation and regulation and the costs of regulating legal cannabis use. Although Colorado, Washington State, Alaska and Oregon adopted a for-profit commercial sales supply model in their legalization of cannabis, there are eight supply options that exist in a spectrum from prohibition to a for-profit commercial model (Figure 3). The features and risks and benefits of each supply option are described in Table 9.(7) Conclusion from the report were outlined by Caulkins and Kilmer (2014).(27)
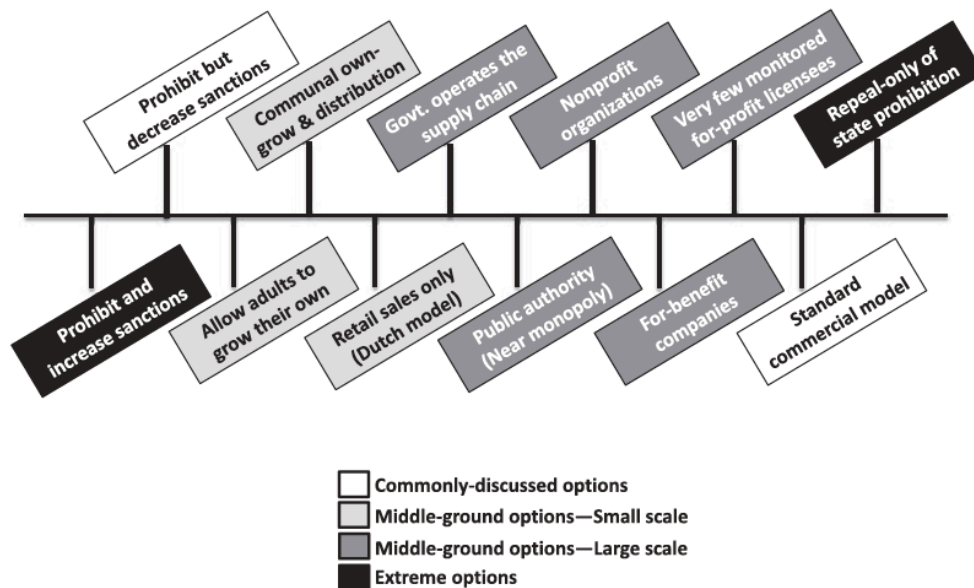
Figure 3 Twelve alternative to status quo prohibition of cannabis supply, taken directly from (27)

Table 9 Cannabis supply alternatives, adapted from (7)

Supply system	Features	Risks and benefits
Prohibit and increase sanctions	Increased sanctions for cannabis-related offenses	Increased cannabis arrests and subsequent social and economic consequences of arrest record.
Prohibit and decrease sanctions	Decrease fines for possession, Reduce number of investigations, prosecutions, presence/length of sentences, and level of enforcement Expunge criminal records for cannabis offenses	Reduced cannabis arrests and subsequent social and economic consequences of arrest record.
Allow adults to grow their own	Allow limited home cultivation of cannabis by adults	Minimal overall effect in Alaska, Washington, D.C. and Colorado Home growers tend to be heavier users May not eliminate black market options Limited revenue generation opportunity May enable illegal commercial production Limits production of exotic or flavored products
Communal own-grow and distribution	Adults grow their own plus share (or sell at cost)	Illegal producer may feign being cannabis clubs as a cover Confines the industry to traditional or artisanal production methods Undermines a large segment of the illegal market Confining distribution to club members means little incentive for advertising Large clubs may have large enough operation to encourage production of concentrates and edibles
Retail sales only (Dutch model)	Small amounts (5g) can be possessed and used in designated coffee shops. No sales of hard drugs or to minors are allowed. Currently several hundred coffee shops in 25% of Dutch municipalities. Most forms of advertising are banned and shops must be 250m from any school.	Legalizing retail sale, possession and use eliminates a large portion of criminal sanctioning Possibility of drug tourism from neighboring jurisdictions, and subsequent disorder Difficult to tax Tension due to illegal nature of production but legal sale
Government operates the supply chain	Government retains monopoly control over supply chain.	Benefits of government monopoly include control of diversion, reversibility (easier to switch to more open supply models), avoiding advertising and product innovation and preventing a price collapse. Problems with this model include government inefficiency.

Supply system	Features	Risks and benefits
Public authority (near monopoly)	Legislation creates a single special-purpose entity (public authority) to be sole supplier and distributor.	A varying level of independence could be afforded to the authority.
Nonprofit organizations	Licenses only granted to non-profit organizations.	Non-profit organizations still subject to all licensing rules and regulations. Does not ensure a lack of expansions or influence. Need term limits for board members and way to reduce empire building.
For-benefit companies	Allow only companies that incorporate social goal into governing documents to sell.	Required to measure the material impact on society and the environment as well as generate profits.
Very few monitored for-profit licensees	Create a small number of licensees to drive up value of a license.	Regulatory agencies will need protection from industry influence, ability to regulate aggressively, and to structure incentives and regulations to promote voluntary compliance and promote public health.
Standard commercial model	Production, distribution and sale up to the private market, with regulations regarding: • Age • Quality control • Packaging • Industry structure • Product selection • Retail operations	Can limit amount produced to serve only domestic market Can limit cannabis sales to dedicated stores (limits cross-price subsidization and access by minors) A revenue department or liquor board is charged with implementing regulations. Could lead the market to develop in a non-public health friendly manner – possible product innovations are difficult to control.
Repeal-only of prohibition	Repeal prohibition only	Creates no positive action or special condition regarding cannabis.

1.13.1 Taxation of cannabis

Taxation of cannabis will provide a tool to reduce heavy use and reduce the risks of export and black market activity. The task of setting appropriate tax levels will be complicated by the potential for dramatic and unpredictable changes in production costs and products of choice and the existence of a large black market at the onset of legalization. High taxes would decrease consumption, increase black market activity and encourage cross-border access. Low taxes will decrease black market activity, encourage compliance but may increase heavy use and underage consumption. Taxes can also be used to shape use by encouraging lower risk products and practices. The RAND Corporation Vermont report examined eight options for taxation of cannabis (Table 10). The criteria considered included the prevention of after-tax price collapse, swiftness of tax assessment, potential for gaming (i.e. loopholes or cheating), simplicity, set-up and ongoing administrative costs and maximization of revenue as the industry evolves.(7)

Some options for the taxation of cannabis require accurate measurement of THC concentrations. These taxation options would require significant investment in equipment, personal and infrastructure to be implemented at the scale needed for the recreational cannabis industry. Accurate measurement of THC concentrations might also be considered necessary for ensuring the safety of consumers. John Fowler, an industry expert, states that THC-testing equipment is relatively straightforward for basic product (i.e. flower), extract product (i.e. oil) and products (i.e. edibles). Some variation will occurs between buds, however, extracts and products should be very uniform. Costs of THC-testing range from several hundred to several thousand dollars. Cannabis plants from the same strain grown in the same environment will be relatively consistent in terms of THC-content. A bit more variability occurs in a greenhouse environment. Plants from different strains can have widely different THC-contents (e-mail to Katherine Gaudreau from President and CEO of Supreme Pharmaceutical, John Fowler, January 25, 2017; unreferenced).

Table 10 Cannabis taxation options, adapted from (7)

Base option	Description	Risks and benefits
Simple weight	Tax based on weight	- Need to account for moisture content - Incentive to pack highest THC content into each gram - Very low tax rate would reduce high THC incentive but reduce revenue - Pushes industry away from mass production towards luxurious, artisanal products
Price (Ad Valorem)	Tax based on price	- Price not necessarily indexed to potency (i.e. consumers may pay for location or specific blend of cannabis) - Simple to enact - Favor low-priced products - Increase changes in pre-tax price of products - Risk of initially very high taxes as legal industry sets up, encouraging black market sales followed by abnormally low prices with economies of scale that encourage underage and heavy use and sales to other jurisdictions - Concerns about bundling with other products if sales not done through cannabis-only retailers - Might be perceived as excessive
Actual THC potency for: - Concentrates - Plant matter - Both concentrates and plant matter	Tax based on potency	- Taxing potency correlates better with intoxication - For concentrates, material is homogeneous enough for testing - For plant matter, THC concentration is far from homogeneous - Considerable time, expense and organization required to set up - Could be set-up once legal markets established and black market share reduced using another tax base in the interim
Taxing bud more than trim by weight*	Tax bud and trim at different rates (i.e. as in Colorado)	- Indirect way of taxing a THC-proxy for potency - Tax evasion potential by adding to the trim and reducing the bud for taxation
Taxing raw usable cannabis and concentrates differently	Tax plant matter and concentrates	- Avoid problems with measuring THC in raw cannabis and with differentiating between bud and trim - Tax all raw cannabis at base rate, then tax concentrates at a

Base option	Description	Risks and benefits
	at different rates	high weight-based rate or by THC potency.
Claimed-THC alternative minimum tax base	Using reported or claimed THC as secondary or alternative minimum tax	- Tax owed would be the greater of 1) tax computed using primary tax base and 2) tax using claimed THC - For situations where the primary tax base was too low (i.e. with high THC content product in a weight-based system)
Square-footage base	Tax indoor and outdoor growing area	- Tax square footage of growing are per plant cycle (not per year) to reduce incentive for high producing crops - Needs to be combined with other bases - Higher oversight needs
Indoor-electricity add-on base	Tax either excessive electricity use (for presumed illegal and legal indoor growing operations).	- Pushes growers towards the greener option of outdoor or greenhouse growing - Applying the tax on excessive electrical use avoid providing a black market advantage

*Bud = product of flower, including the flower and small leaves below the flower
Trim = any part of the plant except the bud

Tax collection should be planned for choke points in the supply chain, to limit the number of people involved in paying the tax, decrease the administrative burden and to improve audit coverage. Taxes would need to be periodically adjusted as the industry adjusts to legalization with the goal of maintaining a steady after-tax price adjusted for inflation. Scheduled tax increases, staggering of the implementation of tax bases (if multiple bases are used), discretionary rate setting and nonrated adjustments are possible strategies from these tax adjustments.(4)

Another potential source of revenue generation is the use of fees. These include application fees and annual registration fees. The fees can be geared to the size of the business or apply to all legal recreational cannabis operations. A larger fee for entry into the industry would ensure a smaller number of larger, more professional producers that are easier to regulate. Fees could also be charged for weighting or potency testing, depending on the tax base used. Auctioning of permanent or annual growing licenses can be an alternative to fees and would provide revenue to help fund the legalization process.(7)

Consumer fees could be used to charge for the privilege of buying cannabis, either for non-residents or for all buyers. This could discourage cross-jurisdictional shopping.(7)

1.13.2 Regulation of legal cannabis

There are also eight high-level areas for consideration in the development of regulations for legal cannabis sales, including:
1. Type of products permitted
2. Cannabinoid content (i.e. THC, CBD)
3. Retail outlets and delivery services
4. Sales to nonresidents
5. Pricing control strategies
6. Prevention and counter marketing
7. Vertical integration
8. Local autonomy versus uniformity (7)

Table 11 explores examples of possible regulations in the legal cannabis industry. Each area of regulation provides many options for creating regulations to reduce black market activity, support public health and harm reduction goals and ensure tax revenue collection.(7)

Table 11 Regulation development areas for legal cannabis regulation, adapted from (7)

Area of regulation	Examples
Product	
Type of product	Legalize only cannabis plant material
Additives or packaging attractive to children	Ban cannabis infused candy or fruit flavors
Potency or strength	THC ceiling or CBD floor
Product labeling	Packaging must be unbranded and free of logos and designs
Packaging	Cannabis to be sold in resealable, opaque, child-resistant containers
Seller or server and sales	
Inventory-control system	Require participation in inventory-control system
Age of sellers and servers	Restrict age of handling or selling cannabis
Vendor and server training/responsibilities	Require training on providing potency and risk advice
Type of outlets	Require sales from cannabis-only stores
Outlet density and location	Limit density to avoid over-availability and presence near vulnerable populations
Vending machines	Prohibit cannabis products in vending machines
Days of sale and hours of operation	Limit hours and days of sale to those of alcohol
Happy hours and bulk discounts	Prohibit bulk discounts and happy hour sales
Quantity and promotional discounting, free samples	Prohibit coupons, discounts and giveaways
Sales quotas and limits	Limit cannabis purchases within a period of time
Nonresident access	Limit sales to residents only
On-premise consumption	Prohibit on-premise consumption of cannabis alone and in conjunction with alcohol
Product placement	Prohibit self-service displays and require a store attendant to service
Minimum pricing	Minimum price for 1mg THC
Marketing	
Physical location and size of advertising	Ban off-premise marketing
Electronic advertising	Online advertising ban a condition of license
Product placement and sponsorship	Prohibit sponsorship of sports, entertainment and school events
Ads targeting youth	Ban images geared to youth (cartoons, animals, etc.)
Possession, Use and Purchase (PUP)	
Age of possession, use and purchase	Restrict PUP for those under a specific age
Method of consumption	Prohibit product used for dabbing
Use in public	Add cannabis to smoke free places act
Use before or while driving	Limit THC blood levels for drivers
Possession of diverted (non-tax-paid) product	Apply criminal penalties to non tax-paid cannabis
Providing access to minors	Apply civil penalties for providing access for minors and for hosting event enabling access by minors
Prevention	Use tax revenues to fund prevention and health promotion activities related to cannabis

Costs associated with regulating legal cannabis include costs related to regulating licensed entities (i.e. producers and vendors), enforcement of laws against consumption, possession, reselling and non-licensed producers and distributors.(7)

A similar description of policy options appeared in the 2016 Vermont Health Impact Assessment.(28)

1.14 Regulations in other jurisdictions

This section describes regulations for the production, distribution and sale of cannabis in other locations where it's use is legalized. The focus for this section is on where retailers are permitted to operate, the application process and requirements for production and consumption, facility requirements, inspection and enforcement and penalties.

1.14.1 Europe (Italy, Spain and Portugal) and Latin America

Possession of psychoactive drugs does not carry criminal penalties in Italy, Spain, Portugal and many countries in Latin America.(7) Despite the lack of criminal penalties, recreational cannabis remains an illicit substance. As a result, these regions will not be considered further.

1.14.2 Netherlands

The Netherlands tolerates retail sales of cannabis but does not allow commercial production.(7) This creates a challenging situation where retailers are permitted to legally sell products whose production is illegal. Because of the differences between this policy situation and that under consideration in Canada, regulations in the Netherlands will not be considered further here.

1.14.3 Uruguay

Uruguay became the first country to allow nationwide legalization of cannabis in December 2013. In Uruguay, users must be over 18 years of age, register with the government and must obtain their cannabis from home cultivation, a growers' club or a pharmacy. All cannabis advertising and promotional activity is banned. Jamaica and Mexico City are considering similar changes.(7)

There are three ways to legally obtain cannabis in Uruguay:
- *Autocultivo*: individual cultivation of up to six plants with an annual yield of up to 480 grams or 40 grams per month.
- Cannabis club: a civil-registered association with 15 to 45 members farming up to 99 plants in one location. The maximum to be supplied to one individual is 480 grams per year.
- Pharmacy: A registered consumer may buy up to 40g per month or 480g per year at registered pharmacies.(29)

The pharmacy sales option has not been fully implemented yet. Two companies will be providing the cannabis for sale at pharmacies up to an initial maximum of two tons per company. Annual fees for the commercial licenses will generate US$1.3 million in government revenue.(30)

The entire country's supply is being grown at one site adjacent to a maximum-security penitentiary. Prices will be initially set at US$1.20 per gram to help draw consumers away from the black market and this price will apply to low, medium and high-THC products up to a maximum of 15%. The products will have to contain correspondingly higher levels of CBD to reduce potential side effects from the THC. Pharmacy purchases will be restricted to 10g per

week with a maximum 30% profit for pharmacies and buyers will be verified against the national registry. Packaging must keep the product fresh for at least 6 months and it must be stored at the production site. Because the pharmacy sales option may have the largest impact on recruiting new users, the full impact of legalization in Uruguay is difficult to determine. A scientific advisory committee has proposed a set of indicators for measuring the full impact of the legalization initiations but there is uncertainty about how well these indicators are being measured.(30)

1.14.4 United States

Washington, D.C. allows for home production and personal possession, whereas Vermont's legislation is still pending.(7)

In the November 2016 US elections, California, Maine, Massachusetts and Nevada approved ballot initiative for legalizing non-medical cannabis use. Arizona's initiative was defeated.

Along with Colorado, Washington State, Alaska, Oregon and Washington, D.C., where legalization of non-medical cannabis use is already in place, 21% of US residents now live in states that regulate rather than penalize cannabis use.(31)

1.14.4.1 Alaska

In November 2014, Alaska voters opted to legalize the recreational use of cannabis. As of February 24, 2015, the use and possession of up to one ounce of cannabis is legal for those over 21 years of age.(32) Initial taxation rates will be $50 per ounce to be paid by the grower on transfer to the retail outlet (an effective tax of approximately 20%).(33)

1.14.4.2 Colorado

Recreational cannabis use has been legal in Colorado since 2012. Prior to this, medical cannabis had been commercialized and expanded from 2009 onwards and medical cannabis had been available from 2006 to 2008.(34)

The legalization of cannabis in Colorado meant that anyone over 21 years of age could possess one ounce of cannabis or grow up to six plants for their own use. Infused products were also available for sale. It remained illegal to provide cannabis to those less than 21 years of age. Driving under the influence and public use were also prohibited. Operators of cultivator or sales facilities required background check and were barred if they had a past felony conviction. Local governments could decide whether to allow recreational cannabis stores, infused products businesses or cultivators in their districts.(35)

Legalization in Colorado created four different cannabis regulation models and the variety of legal ways to obtain cannabis proved challenging for law enforcement (Table 12).(35)

Table 12 Cannabis regulation and oversight models in Colorado, taken directly from (35)

Medical Commercial	Recreational Commercial
• Licensing for Businesses, Owners and Employees • Licensed by Department of Revenue, Marijuana Enforcement Division • Regulatory Authority: Marijuana Enforcement Division	• Licensing for Business, Owners and Employees • Licensed by Department of Revenue, Marijuana Enforcement Division • Regulatory Authority: Marijuana Enforcement Division
Caregiver/Patient	**Recreational Home Grows**
• Caregivers who can grow for up to 5 patients and themselves • Routinely see large grows • Patients are licensed by Colorado Department of Public Health and Environment • Caregiver Regulatory Authority: Colorado Department of Public Health and Environment and local law enforcement	• Anyone 21 years of age or older can grow up to 6 plants. Law enforcement is seeing "Co-op" cultivations where a number of adults over 21 grow their marijuana at one location. This scenario is challenging for law enforcement because officers are uncertain which area of Amendment 20 or 64 may apply to the cultivation. • No licensing required • Regulatory authority: local law enforcement.

Medical and recreational cannabis are subject to a 15% wholesale excise tax, a 2.9% sales taxes and a 10% excise tax on retail sales, local state taxes with some jurisdictions adding an additional tax (i.e. Denver adds an additional 3.5% tax).(33,35) This results in an overall 29% effective tax rate, with plans to drop the 10% excise tax to 8% in July 2017 to encourage users to shift from the black market.(33)

Legalization of cannabis in Colorado was also accompanied by legal requirements for data collection and reporting regarding impacts on public safety, youth and public health. These requirements proved difficult to meet without a pre-defined data collection and reporting system.(36)

1.14.4.3 Oregon

In November 2014, Oregonians voted to legalize retail sale of recreational cannabis in the state although legal retail store sales did not begin until late 2016. It is too early to assess the effects of the legal sale of recreational cannabis in Oregon. Oregon has been collecting temporary 25% tax since January 1, 2016, to be replaced with a 17% state tax and an optional 3% local tax once the retail regulatory regime is fully implemented.(37)

1.14.4.4 Washington, District of Columbia

Washington, District of Columbia (D.C.) allows for home production and personal possession.(7) Prior to legalization, decriminalization of the recreational use and possession of cannabis was introduced in July 2014. In February 2015, the District of Columbia legalized:

- Indoor, home cultivation of up to six cannabis plants where up to three can be mature plants
- Possession of two ounces or less of cannabis
- Transfer of one ounce of cannabis to another person 21 years of age or older as long as no money, goods or services are exchanged
- Home use by adults 21 years of age or older in small quantities.(38)

It remained a crime to:
- Possess more than two ounces of cannabis
- Smoke or consume cannabis in a public space or where the public is invited
- Sell cannabis to another person
- Operate a vehicle or boat while under the influence of cannabis
- Possess any amount of cannabis for those under 21 years of age (38)

Drug-free zones exists within 1000 feet of day care centers, schools and public pools, playground, arcades, youth centers, public libraries and public housing with fines doubled for distribution or possession offenses in these areas. Landlords can set cannabis consumption rules for their rental properties.(38)

Maximum penalties for cannabis violations:
- Consumption in public: 60 days in jail; $500 fine
- Selling cannabis: six months jail; $1,000 fine for first offense
- Distribution, manufacturing and possession with intent to distribute: 5 years jail; fine of $50,000
- Restaurant and business owners who allow cannabis use: Revocation of business license
- Use in federally-subsidized public housing: eviction
- Otherwise legal use: denial of federal job or loss of security clearance (38)

1.14.4.5 Washington State

The Northwest High Intensity Drug Trafficking Area (NWHIDTA) reported in March 2016 on the impact of the legalization of cannabis in Washington State. Since legalization on July 8, 2014, recreational user could purchase up to 2,529 grams of cannabis per transaction in dried, concentrate and infused formats.(39)

Possession limits for those over the age of 21 years in Washington State are:
- 1 ounce (28.3g) of usable cannabis
- 7g of concentrate
- 16 ounces of cannabis-infused edibles
- 72 ounces of cannabis-infused liquid (39)

In the first year of legalization, there were 533 producer, 460 processor and 171 retailer licenses issued. Retail licenses could not be held in conjunction with producer or processor licenses and the number was capped at both the state and county-level. Buffer zones of 1,000 feet for retail locations and advertising were created around school, playground, recreation centers, childcare

centers, public parks, public transit centers, libraries and game arcades for youth. Specific regulations were implemented for advertisements. Fees were set to $250 for applications, $20 processing and registration fees and an annual renewal fee of $1,000 per license. License violations were established for public safety, regulatory, licensing and producer violations. Spot checks for sales to minors were included in the regulatory regime.(39) The buffer zone was reduced to 100 feet around schools and playgrounds with the rest left up to zoning officials after great difficulties were encountered in situating retail sales locations.(33)

In the first year, there was approximately 27,000kg of cannabis produced, with the majority (68%) being used in baked goods or desserts. Production is tracked from seed to sale using BioTrackTHC (https://www.biotrack.com) and a unique barcode applied to plants once they reach eight inches in height. The state employs five examiners to ensure the industry is meeting state standards for inventory, shipment, transports and testing and to prevent illegal sales. Transport is strictly regulated. Packaging regulations are extensive and include label contents, design and health warnings. Packages must be easily divided into single servings. A single serving cannot exceed 10mg of active-THC and an infused product cannot contain more than 10 individual servings.(39)

Figure 4 Washington State cannabis packaging examples, adapted from (39)

Multiple levels of testing are required for each lot of cannabis sold in the state at a cost of $25-80 per sample. Excise taxes were set at 25% for each movement from producer to processor,

processor to retail and retail to consumer. Combined producers/processors pay the 25% tax only once. Tax revenues were funneled into a dedicated fund for administration, reporting and education related to the legalization of cannabis. Regular retail sales tax also applies to cannabis sales.(39) In July 2015, the excise tax was increased to 37% charged only once to avoid unintentional double taxation. Agreements with First Nations groups ensure similar regulatory and tax environment on reserve.(33)

Medical cannabis patients can register voluntary to obtain a recognition card that allows for higher personal possession limits and for possession by those under 1 years of age.(39)

1.14.4.6 Vermont

Legislation legalizing the use of cannabis in Vermont is still pending as of November 2016 due to legislative hurdles.(7,40) Criminal fines for marijuana possession were replaced with civil fines in June 2013.(40)

Impact of cannabis legalization in other jurisdictions

This section examines reports of five United States (US) jurisdictions that have legalized the production, sale and supply of recreational cannabis, including Alaska, Colorado, Oregon, Washington and the District of Columbia. Reports describing the possible impact of recreational cannabis legalization in Vermont are also included. Reports covering jurisdictions that legalize only part of the supply chain (i.e. the Netherlands) or where cannabis is only legalized for medical use are excluded.

1.15 United States

Legalization of recreational cannabis use in the US is a patchwork of policies and taxation (Table 13). A 2016 Tax Foundation Special Report examined the lessons learned about cannabis legalization and taxes in Colorado and Washington:
- Taxes raised were higher than estimated and could be a significant revenue source
- Initial tax rates of 30%+ did not reduce black market sales (10-25% is now proposed)
- Tax on final retail sales most workable – other methods more difficult to implement
- Tackling medical and recreational sales simultaneous is preferable to separate regulations and initiatives (33)

Table 13 Recreational cannabis policies and taxation rates in the United States in 2016, taken directly from (33)

How High Is the Tax on Recreational Marijuana in Your State?
State Excise Tax Rates on Recreational Marijuana, 2016

Notes: (*) Oregon's state tax rate on recreational marijuna will drop to 17 percent in late 2016 and Colorado's rate will drop to 27 percent in July of 2017.
Source: Tax Foundation; compilation of state laws and proposals.

Legend:
- Green: States Where Recreational Marijuana is Legal
- Blue: States With Proposed Ballot Initiatives to Legalize Recreational Marijuana
- Red: States With Legislative Proposals to Legalize Recreational Marijuana

1.15.1 Alaska

As of February 24, 2015, the use and possession of up to one ounce of cannabis is legal for those over 21 years of age.(32) No reports of the effects of this change could be located.

1.15.2 Colorado

A January 2016 report by the Rocky Mountain High Intensity Drug Trafficking Area (RMHIDTA) summarized the impacts to date of this change:
1. Impaired driving
   a. Three-year average cannabis-related traffic deaths increased an extra 37% compared to the overall increase in all traffic deaths
2. Youth cannabis use
   a. Two-year average past 30 days youth cannabis use increased 20% in Colorado compared to a national 4% decrease
   b. Colorado ranks 1st in national youth cannabis use compared to 4th in 2011/2012 and 14th in 2005/2006
3. Adult marijuana use

       a. Two-year average past 30 days college-age cannabis use increased 17% in Colorado compared to a national 2% increase
       b. Colorado ranks 1st in national college-age cannabis use compared to 3rd in 2011/2012 and 8th in 2005/2006
       c. Two-year average past 30 days adult cannabis use increased 63% in Colorado compared to a national 21% increase
       d. Colorado ranks 1st in national adult cannabis use compared to 7th in 2011/2012 and 8th in 2005/2006

4. Emergency Department (ED) and hospitalizations
       a. Two-year average ED cannabis-related visits increased 49% compared to 2011-2012
       b. Two-year average cannabis-related hospitalizations increased 32% compared to 2011-2012

5. Cannabis-related exposures
       a. Three-year average (2013-2015) unintentional exposures for youths aged 0-17 years that involved cannabis and other substances increased 100% and unintentional exposures that involved only cannabis increased 155% compared to 2010-2012

6. Treatment
       a. No change in treatment admissions for cannabis abuse

7. Diversion of Colorado cannabis
       a. Highway patrol seizures increase 37% from 2013 to 2015 and Colorado cannabis was destined to 36 other states
       b. US mail seizures increased over 400% between 2010-2012 and 2013-2015 (34)

Despite the increase in youth cannabis use reported by the Rocky Mountain High Intensity Drug Trafficking Area in 2016, the Drug Policy Alliance reported that youth cannabis use rates have remained stable since legalization in Colorado.(34,41)
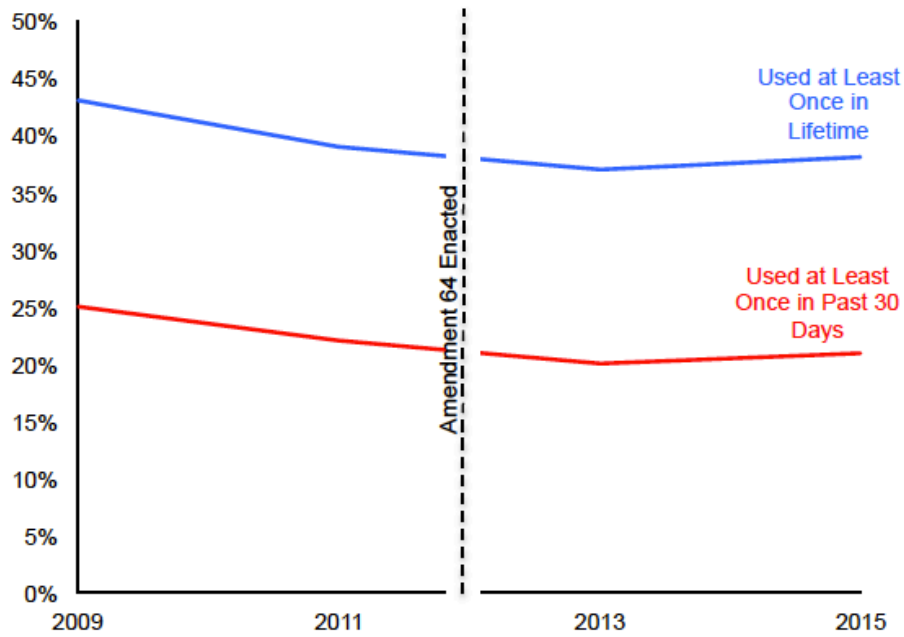
Figure 5 Cannabis use among Colorado youth, taken directly from(41)

A 2016 report by the Colorado Department of Public Safety also attempted to summarize the impact of marijuana legalization in Colorado.(36)

Table 14 Early impacts of marijuana legalization in Colorado, adapted from (36)

Domain	Outcomes
Public Safety	• Decreased cannabis arrests by 46% between 2012 and 2014 • Decrease in arrests not evenly racially distributed (51% drop for Whites, 33% for Hispanics and 25% for African-Americans) • Court filings for cannabis-related offenses dropped 81% between 2012 and 2015 (69% for 10-17 year olds, 78% for 18-20 year olds and 86% for adults over the age of 21) • Cannabis-involved DUIs increased from 12% of DUIs in 2014 to 15% of DUIs in 2015
Public Health	• Current cannabis prevalence for 18 to 25 year olds increased from 21% in 2006 to 31% in 2014. Similar rate increases for those over 26 years of age were from 5% in 2006 to 12% in 2014 • Cannabis-related hospitalizations increased from 803 per 100,000 (2001-2009) to 2,413 per 100,000 (2014-2015) • Cannabis-related emergency room visits increased from 739 per 100,000 (2010-2013) to 956 per 100,000 (2014-2015) • Poison centre call involving cannabis increased from 44 calls in 2006 to 227 in 2015 • Cannabis treatment admissions have increased only among those over the age of 21 years from 569 to 618 per 100,000, with decreases reported for younger age groups.
Youth Impacts	• Past 30 day cannabis use reported by 20% of Colorado high school students, with use increasing by grade level • Decreased perception of health risks of cannabis use • 2% increase in juvenile cannabis arrest (2012 vs. 2014), with racial disparity evident (8% decrease for Whites, 29% increase for Hispanics and 58% increase for African-Americans)
Other	• By December 2015, 2,538 cannabis businesses were licensed in Colorado, with 70% of these located in Denver • Revenue for taxes, licenses and fees totaled $135 million in 2015 (0.95% of all state taxes) • Decreases in both the property crime (-3%) and violent crime (-6%) rates in Colorado from 2009 to 2014

In 2015, an industry advocacy group estimated that the legal sale of cannabis in Colorado had generated $996 million in sales revenue, $121 million in excise taxes and 18,005 jobs.(42)

A 2015 report from the Police Foundation and the Colorado Association of Chiefs of Police outlined some of the challenges related to the legalization of cannabis. Burglaries were experienced at 13% of licensed cannabis facilities, compared to only 2% of liquor stores in 2012/13. The state experienced an influx of young homeless adults looking to find cannabis-related employment. Cannabis has been a cash-only business in Colorado due to federal money laundering rules and the reluctance of banks to work with cannabis businesses, leading to an increased risk of robberies. Drug sniffing dogs need to be replaced or retrained since they are

trained to sniff out cannabis. Because of the multiple models for legal cannabis procurement in Colorado (see Table 12), the police are having difficulty determining the legality of a particular growing operation. The seed-to-sale tracking system has experienced problems with missing inventory, particularly for medical cannabis operations. The enforcement of driving under the influence of cannabis laws is difficult because of the need for blood testing of cannabis level, costing $250-300 per test. Additional technology in the form of oral fluid testing and a cannabis "breathalyzer" is under development.(35)

1.15.3 Oregon

Retail store sales of cannabis did not start until late 2016. As a result, it is too early to assess the effects of the legal sale of recreational cannabis in Oregon.(37)

1.15.4 Washington, District of Columbia

Washington, D.C. allows for home production and personal possession.(7) A February 2016 report describes the first year of legalized cannabis use in D.C. A working group was formed with stakeholders likely to be affected by the legislative change. Cannabis arrests dropped dramatically after decriminalization and legalization had little effect on arrests for possession. Arrests for distribution or possession with intent to distribute have also generally declined since legalization was introduced.(38)

Two attempts to distribute cannabis for "donations" or gift to donors were made in the first year and arrests were made in both cases.(38)

Extensive training for police officers in the appropriate implementation of the new law as well as public education initiatives were a focus of the first year of legalization. Fact sheets were distributed online, at community meetings and through police stations. Small cards were carried by police officers to ensure accurate information about the new legislation and the possible harms related to cannabis use was communicated to the public. Public health messaging targeted to youth is also occurring throughout D.C.(38)

1.15.5 Washington State

A 2016 report to the National Highway Traffic Safety Administration examined the results of an anonymous roadside survey of alcohol and drug use among drivers in Washington State. The survey examined drivers before the implementation of legal sales on July 8, 2014 and compared the results to those obtained 6 months and 1 year after the implementation of legal sales. Among the 2,400 drivers surveyed, there was no significant increase in the number of THC positive drivers (14.6% before legalization versus 19.4% and 21.4% after legalization). The report did find a significant increase in THC positive daytime drivers (7.8% before legalization versus 18.4% and 18.9% after legalization) but not for nighttime drivers. A lack of significance in the overall and nighttime proportion of THC-positive drivers was related to high variation between sites. Despite the increase in THC-positive drivers overall, the percentage of drivers with THC blood concentration above the 5ng/ml legal limit actually dropped following legalization, from 14.5% before legalization to 4.7% and 11.6% at 6 months and 1 year after legalization.(43)

The Northwest High Intensity Drug Trafficking Area (NWHIDTA) reported in March 2016 on the impact of the legalization of cannabis in Washington State. In the first year, there was approximately 27,000kg of cannabis produced, with the majority (68%) being used in baked goods or desserts. Transport is strictly regulated and illegal delivery services have been frequently shut down.(39)

Multiple levels of testing are required for each lot of cannabis sold in the state at a cost of $25-80 per sample. Average THC-concentration was 21.24% for flowers and 72.76% for concentrate at one retailer in July 2015. Sales in the first year totaled $307 million and generated $76 million in tax revenue. The average cost of one gram of cannabis in July 2015 was $16.32 including tax.(39)

Youth impacts from legalization have included an 80% increase in cannabis-related calls to Poison Center locations. Student drug surveys did not show any changes in cannabis use (Figure 6). (39,41) Youth Driving Under the Influence (DUI) cases have increased since legalization, 200% in 2014 and 65% in the first half of 2015. No change in adult or youth cannabis dependence related treatment admissions were reported. Adult impacts including changes in cannabis use patterns and DUI cases are not yet fully quantified.(39)
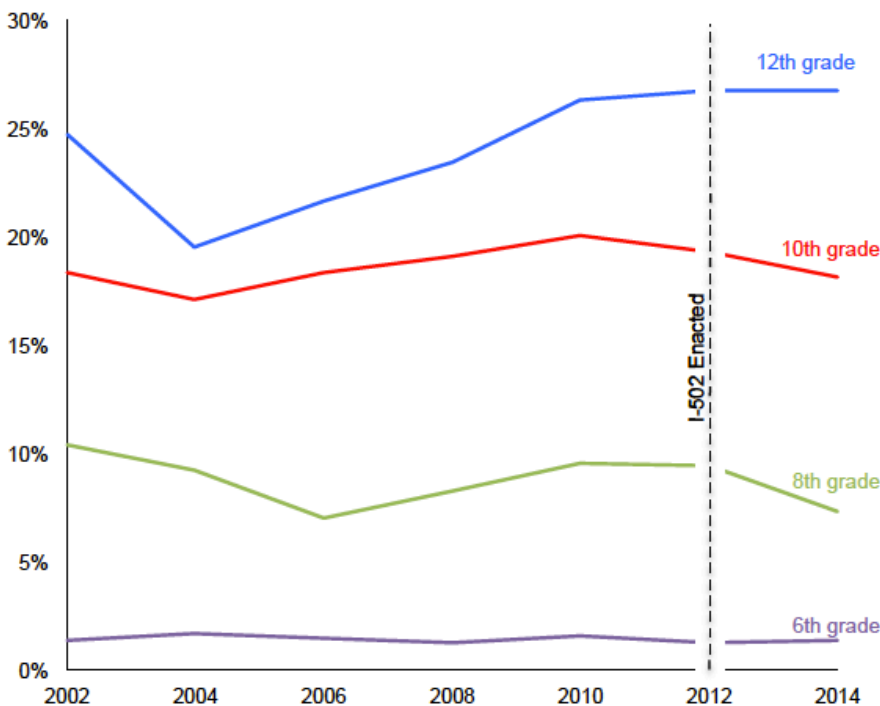
Figure 6 Past 30 day cannabis use among Washington youth, taken directly from (41)

An analysis of the first year of retail sales of cannabis in Washington by the Drug Policy Alliance reported a 98% drop in low-level cannabis offense court filing in adults over the age of 21. Similar decreases in cannabis law violations (63%) and cannabis-related convictions (81%) were reported. Violent crime has continued its 40-year decline in the state. Legalization

generated $83 million in revenue and preliminary reports show no increase in crash risk or use of cannabis by youth.(44)

Washington State has been commended for its innovative approaches to monitoring the effects of legalization. These include using excise taxes to fund research into mitigating social costs of legalization, coordination of research efforts between multiple state agencies and a comprehensive cost-benefit analysis. There have been hurdles in the initial implementation of legalization, including a larger number of producer and retail applications than anticipated and difficulties finding sales locations meeting buffer zone requirements around schools and parks. Washington aimed to convert only 25% of recreational marijuana use to the legal market in its first year of legalization.(45)

1.15.6 Vermont

In 2016, the Vermont Department of Health completed a Health Impact Assessment (HIA) examining to possible impact of the legalization of cannabis in Vermont on the health of state residents.(28) The HIA considered a number of pathways to changes in health with legalizations of cannabis use in Vermont (Figure 7).
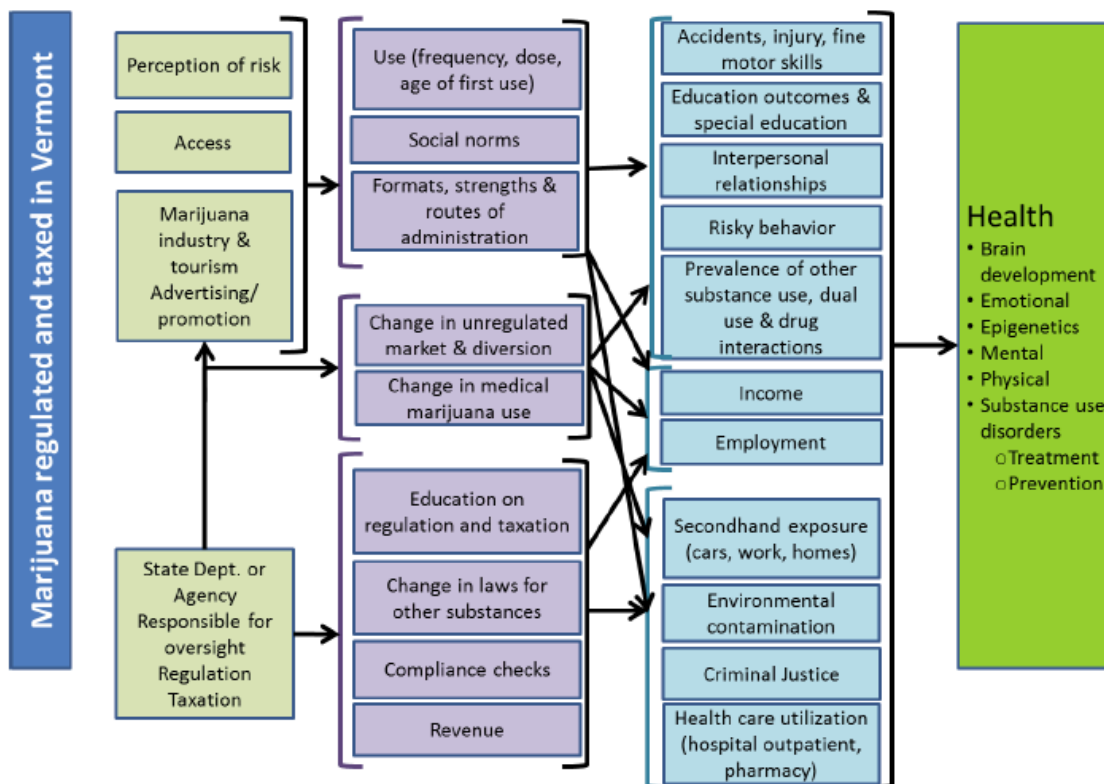
Figure 7 Vermont legalization of cannabis Health Impact Assessment, taken directly from (28)

The 2016 Vermont HIA concluded that legislation in Colorado, Washington, Washington, D.C. and Oregon are all too new to draw specific conclusions about the potential changes in cannabis prevalence with legalization in Vermont.

The Vermont HIA examined the following state-level variables as a baseline for changes related to the legalization of cannabis in Vermont:
- High school and college student cannabis use (prevalence, frequency, age, perception of use, other risk behaviours)
- Adult cannabis use (prevalence by age, driving after use, poor mental health, concurrent substance use (tobacco and alcohol), use before and during pregnancy
- Probation THC-positive drug tests
- Change in THC concentration over time
- Cannabis-involved motor vehicle crashes (overall and fatal) over time
- Literature review of the health effects of cannabis use
- Alcohol use and other illicit drug use, prevalence of cannabis use disorder
- Academic outcomes (literature on academic effects, suspensions, educator surveys)
- Emergency room visits including any diagnosis of cannabis abuse or dependence
- Emergency room visits including a primary diagnosis of cannabis use or dependence(28)

Current cannabis use in PEI

The methods used for data analysis are described in Section 1.2.

1.16 Results

This section presents currently available data regarding the use of cannabis in Prince Edward Island. Data about the perception of harm from cannabis use, patterns of use and negative outcomes of cannabis use in both youth and adult population is presented here.

1.16.1.1 Youth cannabis use

Youth cannabis use information from 2006 to 2012 was obtained from the results of the bi-annual Youth Smoking Survey (YSS). The validated YSS was designed to achieve a representative sample of youth behaviours in all ten Canadian provinces. All public, private and Catholic schools students were eligible. School in the Territories, on military bases or First Nations reserves and for special needs children were excluded. School sampling was stratified based on the health region smoking rate and the type of school (elementary or secondary). All students from Grade five (2006) or six (2008-2012) to Grade 12 were sampled within each selected school. Active permission was obtained from parents of students in Grades six to nine and by school/board request and active information/passive permission was used for high school students. Questions about cannabis were limited to students in Grade seven to 12 and our analysis is limited to those grades.(46–49)

Youth cannabis use information from 2014 was obtained from the results of the new bi-annual Canadian Student Tobacco, Alcohol and Drug Use Survey (CSTADS). Sampling and results from the CSTADS survey are comparable to those from the YSS.(50)

Table 15 presents the number of schools and students participating in each year. Student-level participation rates were not provided in the user guides.(46–50)

Table 15 YSS and CSTADS participation characteristics, PEI 2006-2014 (46–50)

Year	# Schools participating	Response rate	# Students participating
2006	25	86.2%	4,862
2008	58	85%	3,826
2010	54	89%	2,830
2012	53	88%	2,525
2014	53	88%	2,256

All results presented in this reported are weighted to account for the complex survey sampling design.

1.16.1.2 Adult cannabis use

Adult cannabis use information was obtained from the annual Canadian Tobacco Use Monitoring Survey (CTUMS) from 2004 to 2012. CTUMS is a random digit dialing telephone survey conducted annually. The target population is all Canadians aged 15 years and over. Exclusions included residents of the three Territories, full-time residents of institutions and households without telephones. Survey estimates are weighted to include individuals without telephones. Provinces were stratified by rural-urban status (except PEI where there was only one stratum). Households were selected based on random digit dialing and then one or two individuals from

each household were sampled based on the age groups present in the household. The survey was designed to oversample those in the 15 to 19 and 20 to 24 age groups.(51–59)

Adult cannabis use information from 2013 and 2015 was obtained from the new bi-annual Canadian Tobacco, Alcohol and Drug Use Survey (CTADS). The design and sampling was similar to CTUMS.(60,61) In 2013, target individuals without a landline were estimated to account for 22% of the target population, compared to only 3% in the 2004 CTUMS survey.(51,60) Cell phones were included in the sampling frame for the first time in 2015.(61)

Table 16 presents sample size and response rates for each year at the household and person level.

Table 16 CTUMS and CTADS participation characteristics, PEI 2004-2015 (51–61)

Year	# Households participating	Household response rate	# Persons participating	Person response rate	Overall response rate
2004	4,408	86.6%	2,085	88.6%	76.7%
2005	4,174	79.8%	1,818	83.9%	67.0%
2006	4,655	80.2%	2,044	85.0%	68.2%
2007	4,836	75.5%	2,167	86.7%	65.5%
2008	5,010	82.4%	2,166	86.9%	71.6%
2009	4,792	78.1%	1,975	84.8%	66.8%
2010	4,717	75.0%	1,942	81.8%	61.3%
2011	5,324	82.4%	2,185	83.3%	68.7%
2012	5,036	82.5%	1,975	81.4%	67.2%
2013	4,053	82.5%	1,445	81.5%	67.2%
2015	3,633	59.4%	1,428	75.4%	44.8%

1.16.2 Perception of harm

Grade 7 -12 students in PEI perceived that the health harms from cannabis use increased with the regularity of use (Figure 8). Almost half of all students (47%) believe that regular cannabis use would cause great harms to health compared to less than a quarter (19%) of all students for irregular use.

Student-reported risk of harm to health from irregular cannabis use, PEI, 2014 -15

Student-reported risk of harm to health from regular cannabis use, PEI, 2014-15
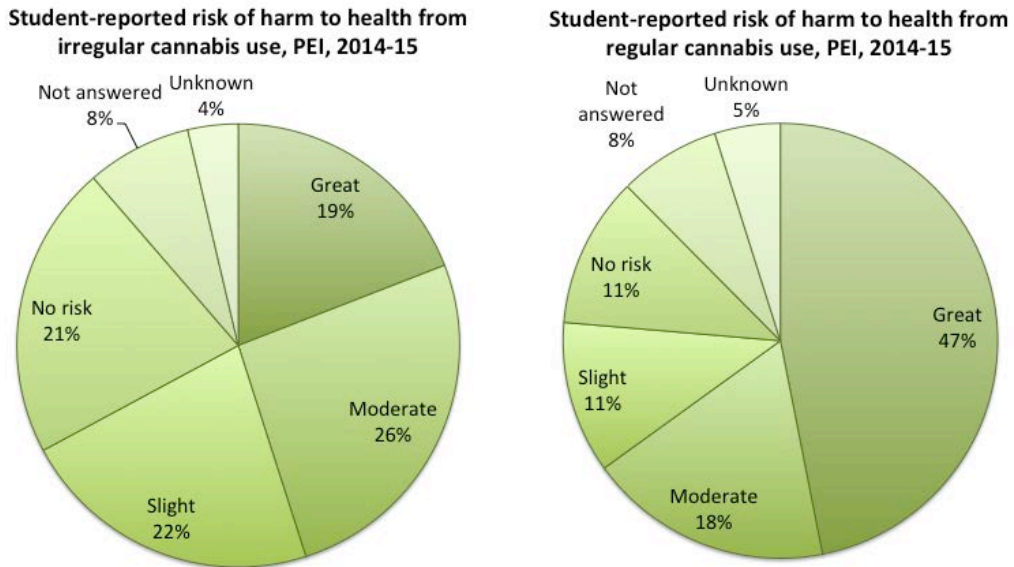
Figure 8 Grade 7 to 12 student-reported perceptions of harm to health from irregular and regular cannabis use, PEI, 2014-15

About half of all students in Grade 7 -12 in PEI reported that cannabis was easy for them to access in 2012-13 and 2014-15 (Figure 9).

	Difficult/Impossible	Easy	Unknown/No answer
■ 2012-2013	27.6	45.9	26.5
■ 2014-2015	36.1	47.0	16.9
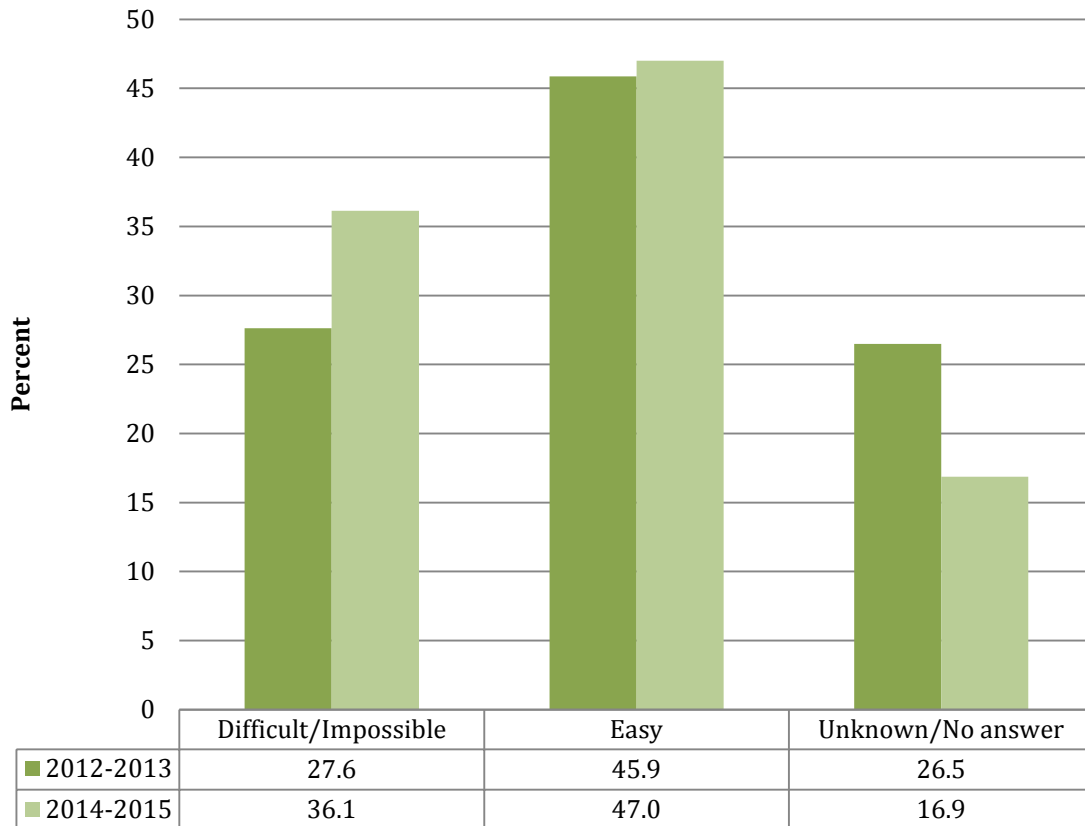
Figure 9 Student self-reported ease of access to cannabis, all grades, PEI, 2012-13 to 2014-15

1.16.3 Youth cannabis use

Approximately one-quarter of all male students and one-fifth of all female students reported trying cannabis from 2006-07 to 2013-14 (Figure 10). These rates increased slightly to 33% of male students and 26% of female students in 2014-15. Male students consistently reported trying cannabis at higher rates than female students.

	2006-2007	2008-2009	2010-2011	2012-2013	2014-2015
Male	26.1	25.1	25.1	26.1	32.8
Female	22.0	19.9	19.3	21.7	25.5
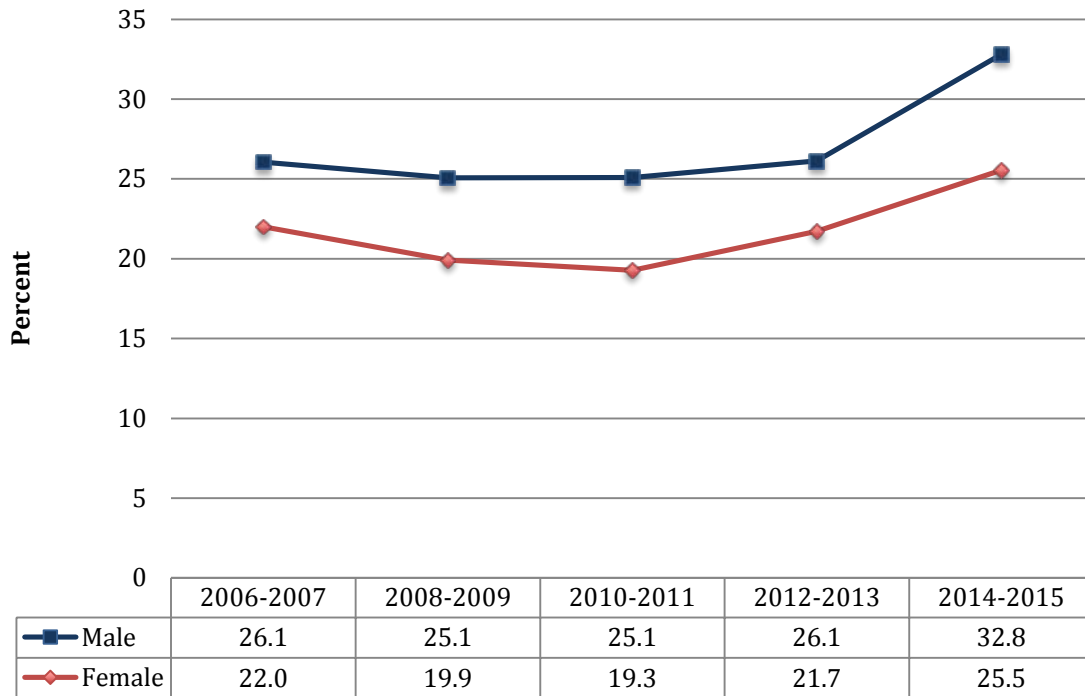
Figure 10 Student self-reported cannabis use, all grades, PEI 2006-07 to 2014-15

Consistently, students in Grade 9/10 and 11/12 have seen increasing trends in cannabis use since 2010-11. The percentage of students self-reporting the use of cannabis increases significantly between Grades 9/10 and Grade 11/12, with almost twice as many Grade 11/12 students reporting use (Figure 11).

	2006-2007	2008-2009	2010-2011	2012-2013	2014-2015
Grade 9/10	22.9	21.5	19.4	23.4	28.1
Grade 11/12	42.9	39.2	40.1	41.5	48.6
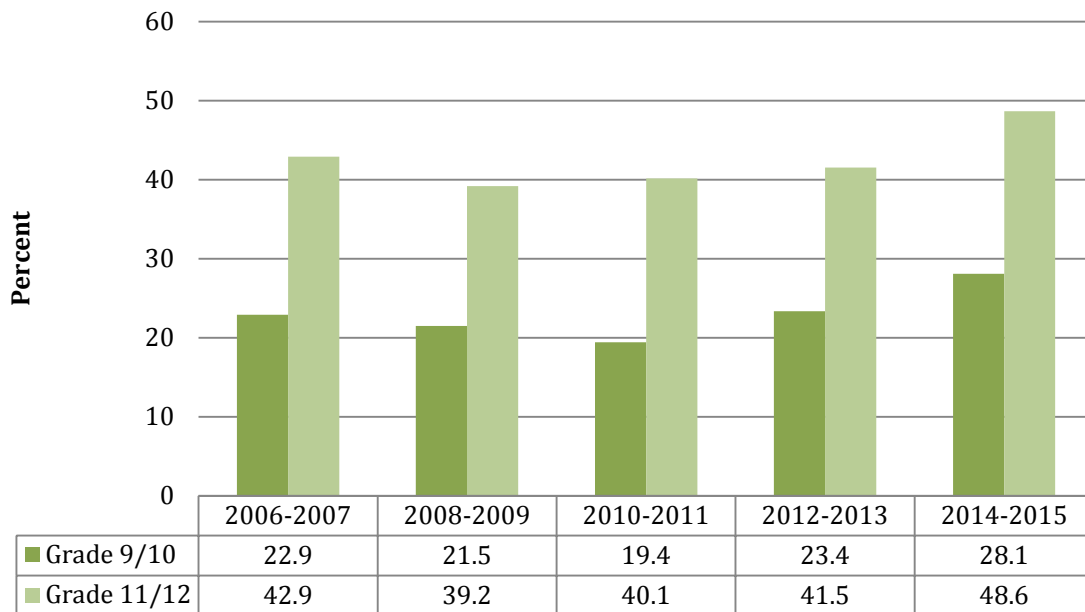
Figure 11 Self-reported student cannabis use by grade[1], PEI, 2006-07 to 2014-15

[1] Grade 7/8 results had high coefficients of variation due to the low numbers of students involved. These estimates were of marginal or unacceptable quality and were suppressed.

Initiation of cannabis use is most likely in Grades 9 and 10 (14 to 15 years old) (Figure 12). This age group is when over 40% of all students who experiment with cannabis have their first experience with the product.

	2006-2007	2008-2009	2010-2011	2012-2013	2014-2015
■ Grade 7/8	22.2	21.3	21.1	22.3	20.2
■ Grade 9/10	48.8	40.9	41.1	41.0	40.8
■ Grade 11/12	20.3	25.1	20.9	21.4	26.2
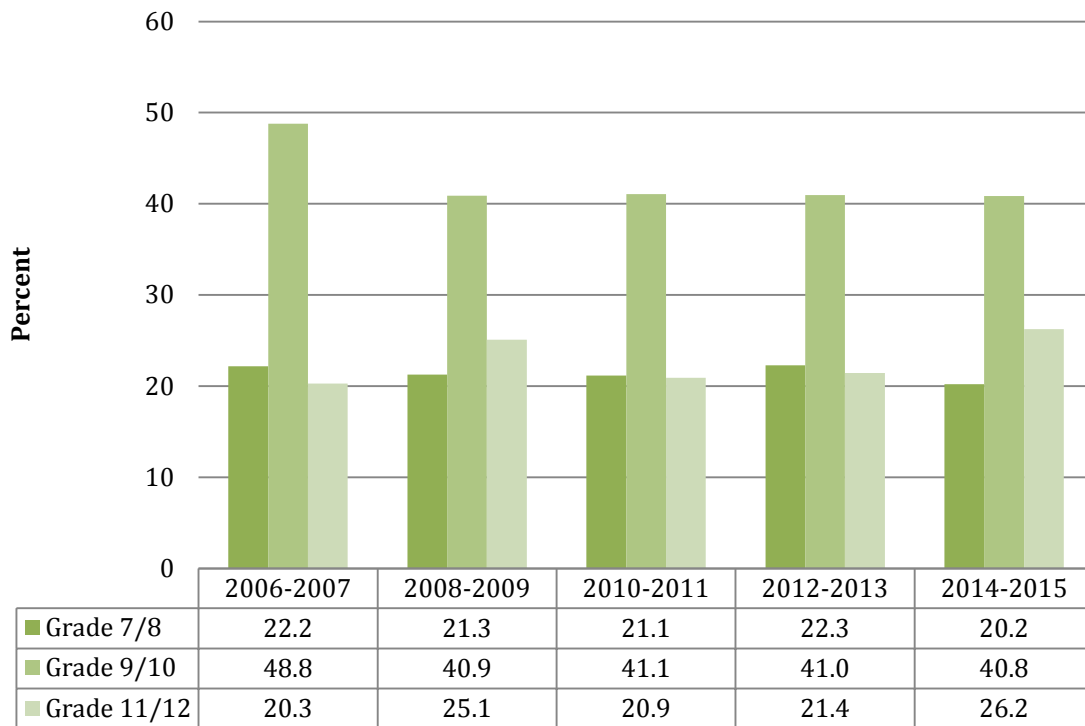
Figure 12 Initiation[1] of first cannabis use, all grades, PEI, 2006-07 to 2014-15
[1]Estimates for initiation before Grade 7 are of marginal quality due to the low numbers involved and were suppressed.

The frequency of cannabis use among Island students who had tried cannabis in the last 12 months showed a generally more frequent use for male students and less frequent use for female students (Figure 13 and Figure 14).

	2008-2009	2010-2011	2012-2013	2014-2015
■ >1/week	25.8	26.3	27.8	20.9
■ >1/month	31.4	33.8	32.7	30.0
■ < 1/month	42.8	40.0	39.5	49.1

Figure 13 Frequency of cannabis use in the last year among female students[1] who have tried cannabis in the last 12 months, PEI, 2008-09 to 2014-15

[1]Estimates for this figure are based on weighted sample sizes of 220-500 and may be associated with a high level of error.

	2008-2009	2010-2011	2012-2013	2014-2015
■ >1/week	42.1	51.3	43.1	41.6
■ >1/month	32.7	24.7	28.9	25.8
■ < 1/month	25.2	23.9	28.0	32.6

Figure 14 Frequency of cannabis use in the last year among male students[1] who have tried cannabis in the last 12 months, PEI, 2008-09 to 2014-15

[1]Estimates for this figure are based on weighted sample sizes of 290-630 and may be associated with a high level of error.

1.16.3.1 Concurrent substance use

Students who never used tobacco, alcohol or other illegal drugs were less likely to report cannabis use. On average, over 80% of students who reported never using alcohol, tobacco or other illegal drugs reported that they had never tried cannabis. Conversely, at least 75% of tobacco smokers report cannabis use, followed by between 50 and 90% of illegal drug users and 50% of alcohol users.

1.16.3.2 Driving and cannabis use

In 2014-15, 8.5% of students reported driving after cannabis use and 21.6% reported being a passenger in a car driven by someone who had used cannabis. This represents the only year of data to date on student cannabis driving behaviour.
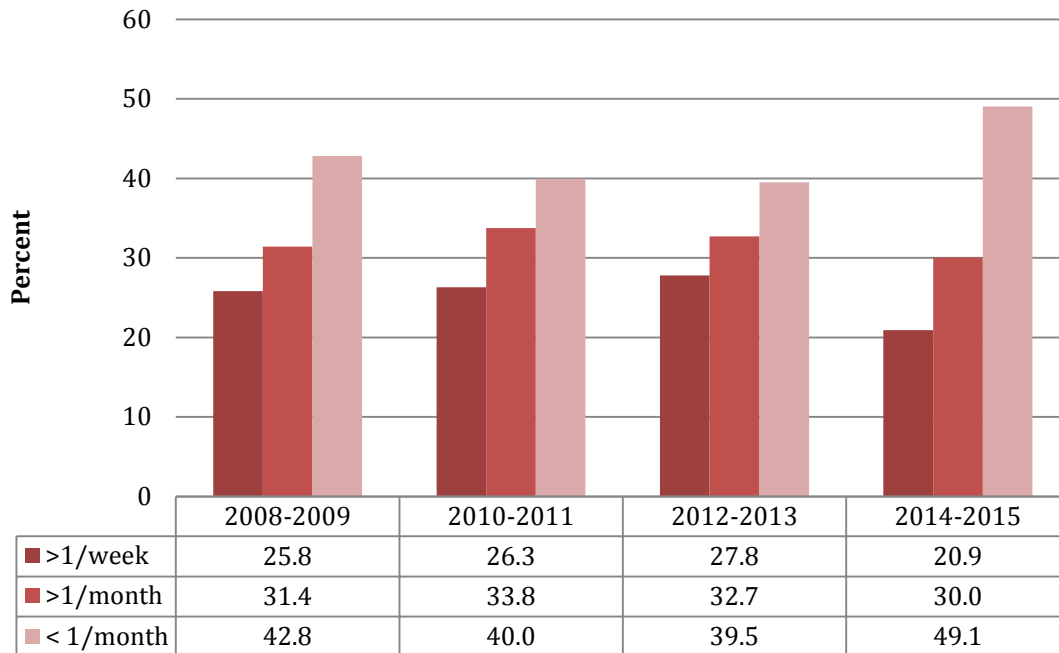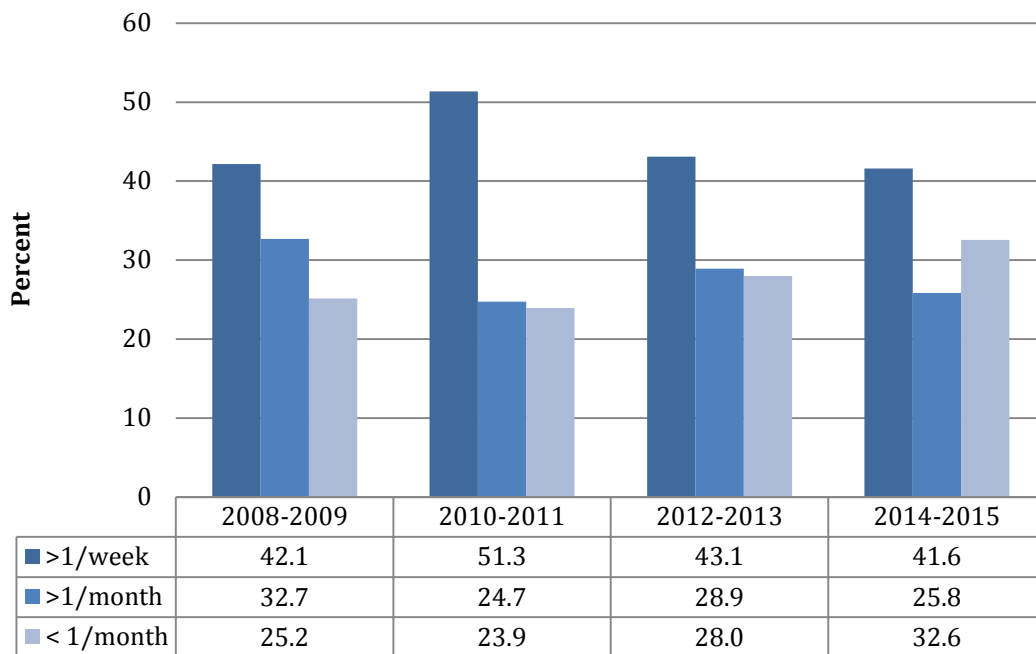
1.16.3.3 Mental health and cannabis use

Students who have tried cannabis score significantly lower on mental health measures of autonomy, relatedness, competency and social responsiveness than students who have not tried cannabis (Table 17). There were no significant differences in high pro-social behaviour scores by cannabis use status.

Table 17 Percentage of students with high scores on mental health measures by cannabis use status, all grades, PEI, 2014-15

Measure	% of students who have never tried cannabis with high scores	% of students who have tried cannabis with high scores	p-value
Autonomy	72.6	63.9	<0.01
Relatedness	84.3	68.1	<0.01
Competency	82.7	65.6	<0.01
Pro-social behaviour	59.6	56.2	0.16
Social responsiveness	97.5	86.4	<0.01

1.16.3.4 Other measures

Students from areas of higher median household income were more likely to try cannabis than those from areas of lower median household income, although the spread of median household income in PEI is very small.

	$45-54,999	$55-64,999	$65-74,999
■ Tried cannabis	27.1	26.6	45.1
■ Never tried cannabis	71.1	73.4	45.1
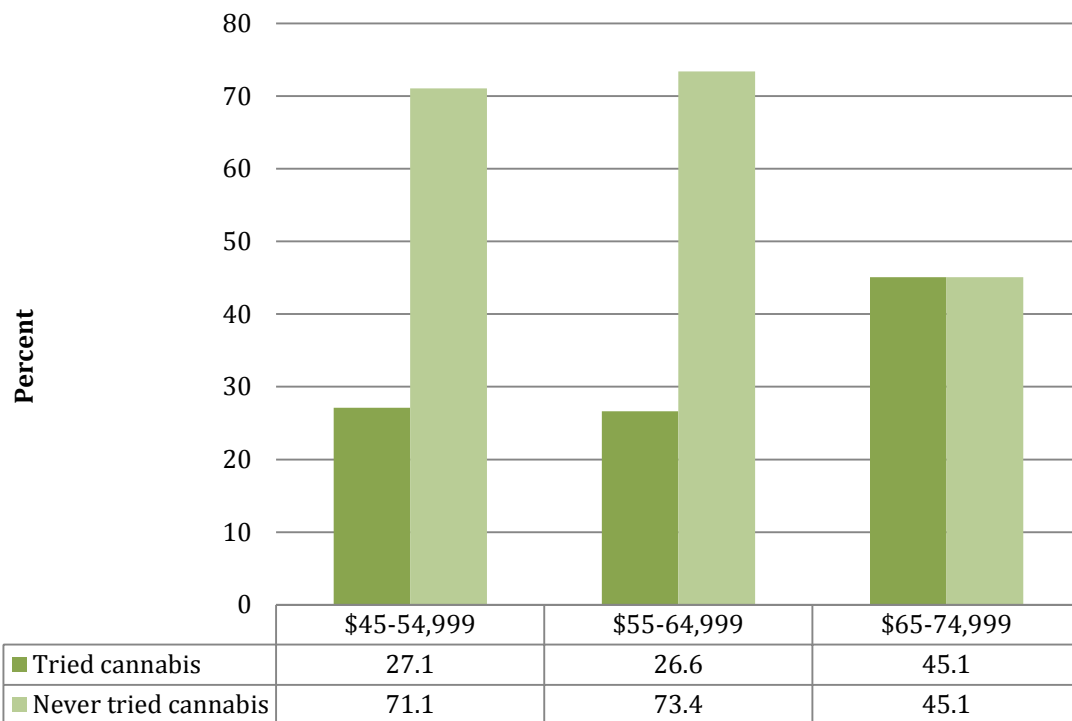
Figure 15 Area median household income distribution by student cannabis use[1], all grades, PEI, 2014-15

[1]Percentages do not add up to 100 due to unknowns.

1.16.4 Adult cannabis use

The national tobacco use survey, CTUMS, was conducted from 2004 to 2012. This annual survey was then replaced by the bi-annual CTADS in 2013. Adult cannabis use data for PEI are therefore annual from 2004 to 2012 and then bi-annual from 2013 onwards.

Lifetime cannabis use includes any prior cannabis use, including one-time only use. Lifetime cannabis use by Islanders has varied between 34% and 49% among men and between 26% and 34% among women between 2004 and 2015 (Figure 16). There has been an upward trend of cannabis use over time (linear trend line Figure 16). One-time only use has increased only slightly over time, remaining between 6% and 10% of men and women.

A University of Calgary analysis of CDUMS and CTADS survey results showed a lifetime use of cannabis by 30.1% of Islanders compared to 33.7% of Canadians.(4)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Male 1-time use	6.4	5.2	6.0	9.2	8.0	7.0	7.6	10.8	8.2	8.4		7.5
Male	33.3	28.8	31.8	33.6	31.5	34.5	35.7	34.3	34.9	40.2		38.0
Female 1-time use	6.5	6.3	6.3	6.4	8.9	7.3	7.3	6.9	7.2	8.2		8.6
Female	19.7	20.2	20.8	20.8	21.4	20.4	21.3	22.8	21.9	20.7		25.4
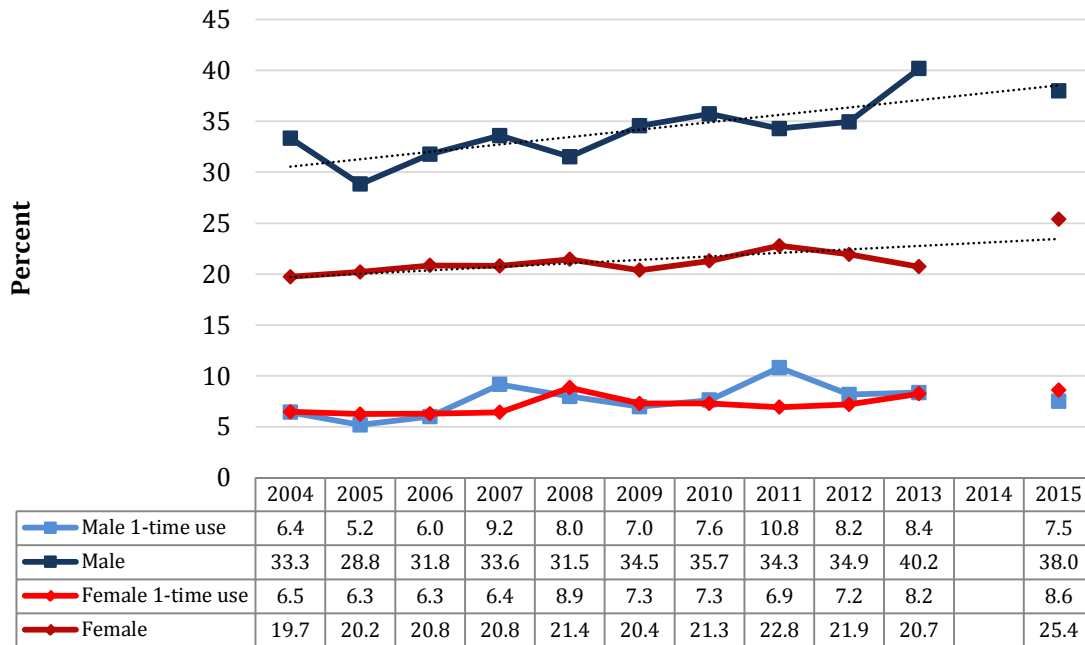
Figure 16 Lifetime cannabis use by PEI residents, 15 years of age and over, 2004-15
Dashed line represents a linear trend line.

Many lifetime users no longer use cannabis. Estimates of the number of Islanders aged 15 years and older that have used cannabis in the last year are approximately 10,000 individuals per year (Figure 17). The estimated number of users increased slightly in 2013 and then returned near baseline in 2015.

A University of Calgary analysis showed that use in the last 12 months remained relatively stable between surveys in 2008 (11.2%), 2010 (9.8%) and 2013 (10.7%). Similarly, Canadian use in the last year has also remained stable at 11.4% in 2008, 10.7% in 2010 and 10.5% in 2013(4).

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Male	6,315	5,997	5,794	5,564	5,525	6,698	5,354	5,879	5,936	8,367		6,227
Female	3,435	3,805	3,841	3,482	3,405	2,703	3,027	3,721	3,270	4,813		3,644

Figure 17 Last year cannabis use, 15 years of age and over, PEI, 2004-2015

Lifetime cannabis use varies by age group. Younger age groups (15-44 year olds) show a linear trend of stable or slightly decreasing lifetime cannabis use during the period from 2004 to 2015 (Figure 18 –dashed lines). Older age groups (45-85 year olds) show a linear trend of increasing lifetime cannabis use during the period from 2004 to 2015 (Figure 18 - solid lines). Increased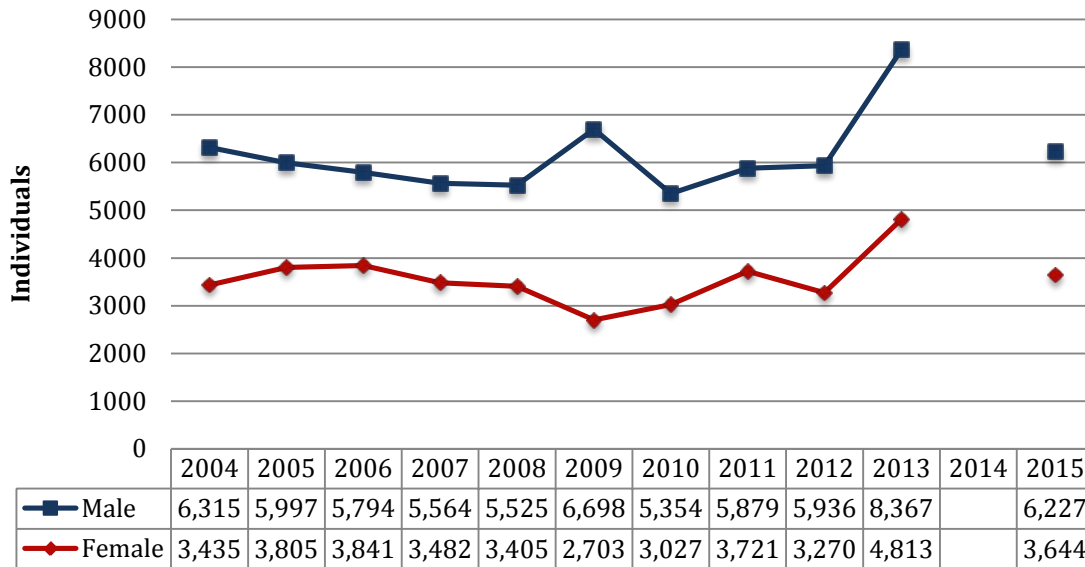 cannabis use in older age groups may be related to the use of medical cannabis. Between 2013 and 2015, lifetime cannabis use increased in all age groups, except for those aged 25 to 44 years.

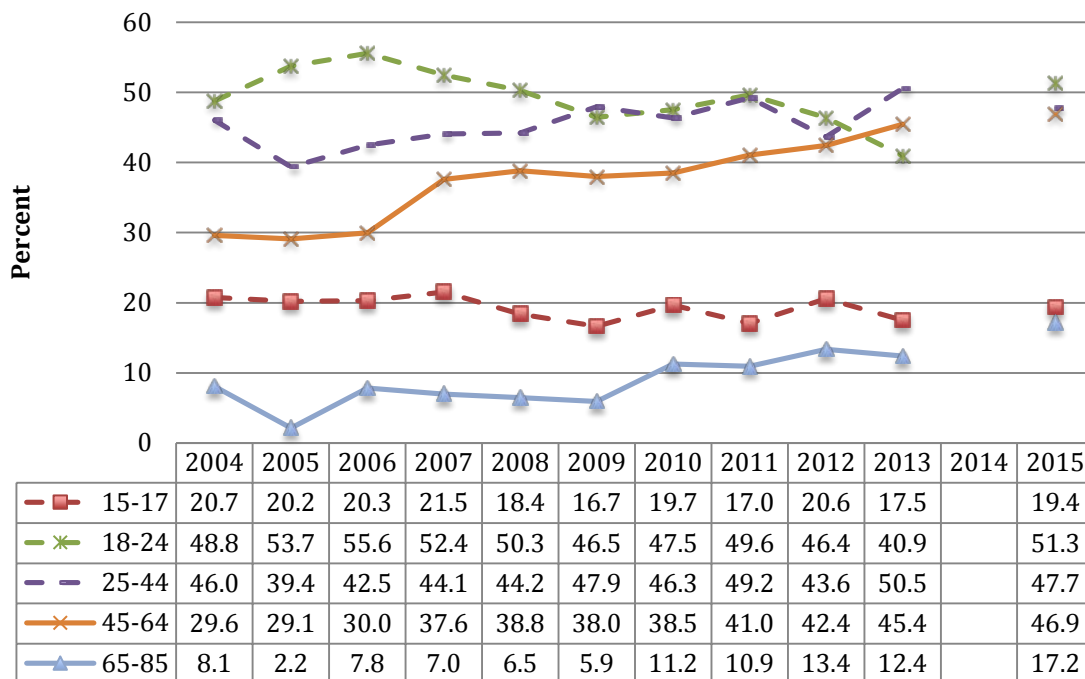|	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
15-17	20.7	20.2	20.3	21.5	18.4	16.7	19.7	17.0	20.6	17.5		19.4
18-24	48.8	53.7	55.6	52.4	50.3	46.5	47.5	49.6	46.4	40.9		51.3
25-44	46.0	39.4	42.5	44.1	44.2	47.9	46.3	49.2	43.6	50.5		47.7
45-64	29.6	29.1	30.0	37.6	38.8	38.0	38.5	41.0	42.4	45.4		46.9
65-85	8.1	2.2	7.8	7.0	6.5	5.9	11.2	10.9	13.4	12.4		17.2

Figure 18 Lifetime cannabis use by age group, PEI, 2004-2015
Age groups represented by a dashed line have a stable or slightly decreasing linear trend. Age groups with a solid line have an increasing linear trend.

Despite a decreasing trend of lifetime use in the younger age groups, Figure 19 shows that the percentage of Islanders who have used cannabis in the last year remains highest among 18-24 year olds (24-32%), followed by the 15 to 17 years olds (11-17%).

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
15-17	13.7	12.5	14.8	13.4	11.4	12.0	14.6	13.9	16.8	14.8		15.5
18-24	28.0	31.8	31.3	26.7	27.6	24.5	27.0	27.9	25.0	26.4		28.7
25-85	5.6	5.3	5.0	5.1	4.9	5.7	4.0	5.0	4.7	8.5		5.3
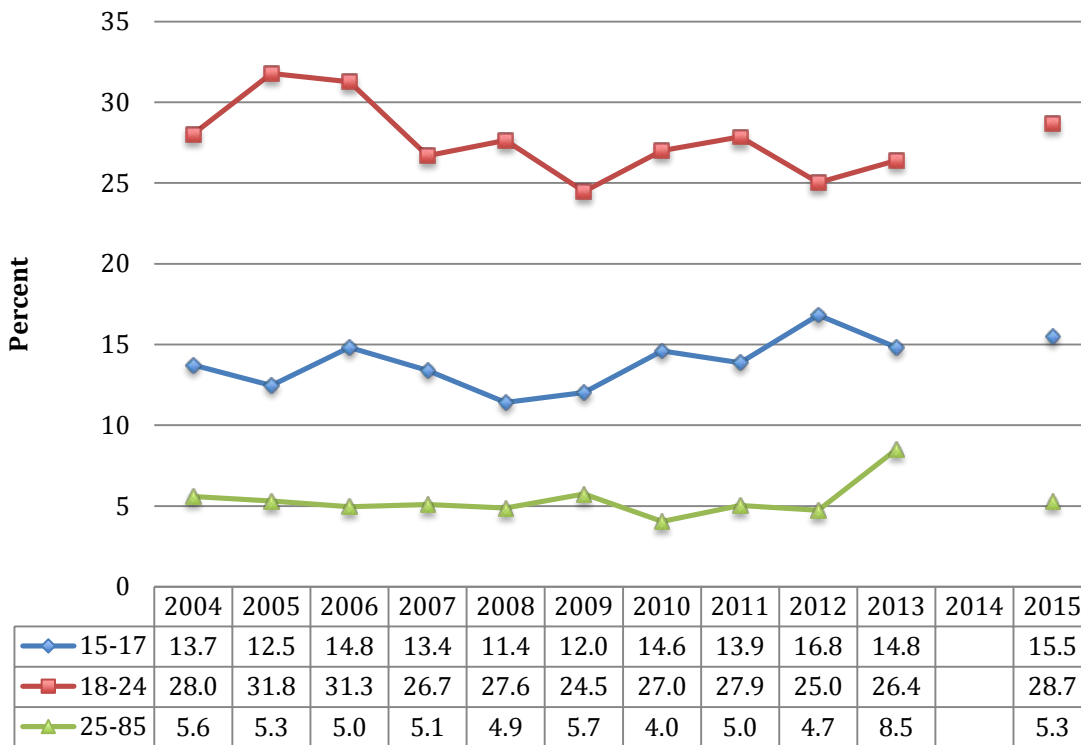
Figure 19 Cannabis use in the last year, by age group[1], PEI, 2004-2015
[1]Age groups were collapsed compared to Figure 18 to meet minimum sample size release guidelines.

Islanders reported that their first use of cannabis peaks at 12-13 years of age and remains high at 14-15 years of age. This differs slightly from the results of the student survey where age at first use was reported commonly at 14 to 15 years. Together, more than 50% of all initiations to cannabis use are occurring before the age of 16 years (Figure 20).

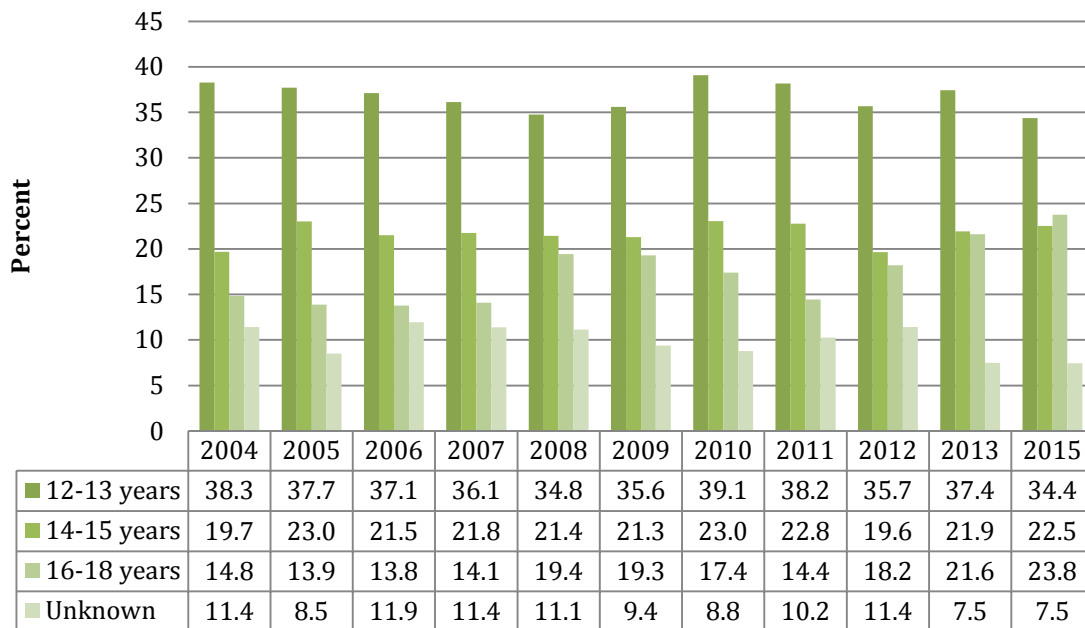|	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2015
■ 12-13 years	38.3	37.7	37.1	36.1	34.8	35.6	39.1	38.2	35.7	37.4	34.4
■ 14-15 years	19.7	23.0	21.5	21.8	21.4	21.3	23.0	22.8	19.6	21.9	22.5
■ 16-18 years	14.8	13.9	13.8	14.1	19.4	19.3	17.4	14.4	18.2	21.6	23.8
□ Unknown	11.4	8.5	11.9	11.4	11.1	9.4	8.8	10.2	11.4	7.5	7.5

Figure 20 Age[1] of first cannabis use, PEI, 2004-15
[1]Estimates for initiation from 8 to 11 years of age are of marginal quality due to the low numbers involved and were suppressed.

In comparison, The University of Calgary showed that Canadians aged 15 to 34 were significantly more likely to use cannabis in the last 12 months compared to those aged 35 to 64 years. Females, those over age 65, with a university degree, married or common-law or widowed were significantly less likely to use cannabis compared to males, 35 to 64 year olds, individual who completed high school, and never married individuals. Income and employment status had no significant effect on cannabis use. National support for legalization of cannabis for non-medical purposes was 65.1%.(4)

1.16.4.1 Risk of harm from cannabis use

The WHO's ASSIST score can be used to describe the risk of harm from cannabis use. Risks associated with cannabis use are scored out of 38. The questions relate to the frequency of use and attempts to cut down, control or stop use. The questions also consider use leading to health, social, legal or financial problems, use causing failure to do normally expected tasks and expressions of concern by friends or relatives. A score of 0-3 represents low-risk use, 4-26 moderate-risk use and 27 or more high-risk use. Patients in the moderate-risk group should receive a brief intervention and patients in the high-risk group should receive more intensive treatment.(62) In PEI, approximately five percent of individuals who have ever used cannabis are estimated to be at risk of harm from their current cannabis use patterns based on 2015 data (Table 18).

Table 18 Cannabis use risk patterns among those with any lifetime cannabis use, by WHO ASSIST score, PEI, 2013-15

	Male		Female	
	2013	**2015**	**2013**	**2015**
Low risk user	90.6	93.2	94.1	94.1
Moderate/High risk user	9.1	4.6	5.4	5.4

*Values do not add up to 100 due to unknowns.

1.16.4.2 Tobacco and cannabis

Both lifetime and current tobacco use are strongly associated with lifetime and current cannabis use among adults over 15 years of age in PEI. Since 2004, about 50% of current or former smokers had also tried cannabis in their lifetime compared to only about 20% of non-smokers. Similarly, about 20% of current smokers have used cannabis in the previous year compared to only 5% of non-smokers.

1.16.5 Cannabis-related hospitalizations

Data analysis of cannabis-related hospitalization on PEI from 2005 to 2014 was provided by PHAS. PEI hospitalization with any cannabis-related diagnosis code have increased slightly from 72 in 2005 to 116 in 2014 but still comprise less than 0.5% of all hospitalizations (Table 19). The majority of cannabis-related hospitalizations have been for mental disorders due to drug use. Poisoning by cannabis has accounted for up to 3 hospitalizations annually from 2005 to 2014.

Table 19 PEI hospitalizations with a cannabis-related diagnosis code[1], hospital discharge abstracts, 2005-2014

	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
N	72	51	56	68	87	78	78	91	117	116
%	0.25	0.18	0.20	0.23	0.28	0.26	0.26	0.31	0.38	0.38

[1]ICD-10 codes T40.7 (poisoning by cannabis) and F12 (mental disorders due to illegal drug use - cannabinoids) in any diagnosis. N: Number of hospitalization. %: Percent of total hospitalizations in PEI

Conclusion

Canada's federal government has committed to the legalization of cannabis for recreational use in Canada by the summer of 2018. Drivers for this policy change include high rates of use among youth, criminal records for non-violent drug offences, success of organized crime and support of public opinion. In preparation for the legalization and regulation of cannabis in PEI, the Chief Public Health Office, through the Population Health Assessment and Surveillance (PHAS) division, examined the health effects of cannabis use, national health statements on cannabis use, cannabis regulations in other jurisdictions, current cannabis use in PEI and possible health impacts of legalization. The information in this report informs a public health approach to cannabis legalization and regulation in PEI.

Cannabis use is associated with short and long-term health harms

Cannabis may be used recreationally to produce a desired 'high' or medicinally for symptom management in patients with HIV/AIDS, cancer, multiple sclerosis, spinal cord injuries, severe arthritis and seizures. However, cannabis is also associated with both short and long term health harms. Short-term health harms are varied and include anxiety/panic/dysphoria, cognitive and psychomotor impairment (e.g. memory, attention, coordination), increased accident risk including motor vehicle collisions, low birthweight pregnancy and acute poisoning in children. Chronic cannabis use is associated with dependence, respiratory effects (asthma exacerbations, cough, sore throat, shortness of breath and hoarseness), impaired cardiovascular functioning, poor mental health and decreased neurocognitive functioning (e.g. learning, memory, attention). Early initiation and regular use of cannabis is associated with poor long-term social and educational outcomes. Given the early stage of cannabis legalization in other countries, there are few long-term studies that collectively assess these health and social harms at a population level. A cautious approach to legalization and regulation is therefore warranted.

Legalization may increase cannabis consumption and population health risk

Many Islanders currently use cannabis. Adult past year usage was 10.7%, which was similar to Canada, and student past year use was 25-30%, increasing with school grade. More than 50% of all initiations to cannabis use among Islanders are occurring before the age of 16. Higher prevalence groups in PEI were similar to Canada including ages 15-34, males, no university degree, never married, concurrent use of alcohol, drugs and tobacco. All data is self-reported and very likely represent an underestimate due to cannabis' illicit status.

Legalization and regulation of cannabis use is anticipated to increase consumption leading to an increase in population-level health harms. The RAND Corporation analysis found that cannabis consumption would likely increase 40-60% over the baseline year in the first year of legalization. Based on early evaluation data from Colorado's legalization of cannabis in 2014, the immediate impact of cannabis legalization in PEI may include increases in cannabis-related emergency room visits, increases in cannabis-related hospitalizations, and increased in unintentional exposures to cannabis products. There is also potential for an increase in youth cannabis use and for a decrease in youth perceptions surrounding harms associated with cannabis use. Long-term population health impacts remain unknown.

Strict regulation can mitigate population health risk

Several national public health organizations including the Centre for Addiction and Mental Health, Canadian Centre on Substance Use and Addiction, Canadian Pediatric Society, Canadian Public Health Association and Canada's Chief Medical Officers of Health have issued position statements intended to minimize health harms associated with legalized cannabis use. These statements emphasize the importance of strict government regulation including control of cannabis production and sale, establishing a minimum age of purchase, restricting advertising and marketing, curbing demand through pricing and taxation, promoting public health messaging and harm reduction (e.g. Lower Risk Cannabis Use Guidelines), and investing in surveillance and research. The Government of Canada has recommended committing cannabis taxation revenue to support public health goals.

Finally, it is vital to recognize that currently two legalized and regulated substances, tobacco and alcohol, contribute to the majority of preventable illness, disability and death in PEI. Similar to experience with the tobacco and alcohol industries, commercialization of cannabis is anticipated to increase consumption and subsequent health harms. A government supply chain monopoly has therefore been recommended by public health organizations with some groups advocating for a non-profit distribution model. These organizations have also joined the Government of Canada's Task Force in strongly recommending against co-location of cannabis with tobacco or alcohol at retail locations. PEI's selection of a cannabis distribution and sale model will be a key aspect of cannabis regulation that will influence cannabis consumption and public health risk.

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Appendix A: Assessing the potential impact of legalization

The RAND Corporation prepared a report for the Vermont State Legislature in 2015 that examined the legal basis for legalization of cannabis in the state, current cannabis use and enforcement costs in Vermont, the scientific literature on the effects and benefits of cannabis use.(7) Conclusion from the report were outlined by Caulkins and Kilmer (2014).(27)

In examining current cannabis use in Vermont, the report considered the criminal and civil penalties for cannabis offenses and the current use of medical cannabis in Vermont. The cost of substance abuse prevention and treatment for cannabis use are compared to the costs of other substances, including alcohol. The report examines the difficulty in estimating the use of cannabis from population surveys and suggests methods to correct for under-reporting. Cannabis-involved emergency room visits were also considered in estimating cannabis use in Vermont. A formula for combining population survey use estimates and adjusting for underreporting is presented. Monte Carlo simulations were used to estimate the total amount consumed and annual spending on cannabis. Detailed methods are presented to estimate criminal and civil enforcement costs.(7)

In examining the effects of cannabis legalization on health (Table 20), the RAND corporation report considered two questions:
1. What effects does cannabis use have on health and other outcomes?
2. What effect would a change in cannabis legislation have on patterns of use and therefore on health and other outcomes?(7)

The total harm of cannabis legalization is a product of the harmfulness, intensity and prevalence of use. Change in any of these three factors will impact the overall harm from cannabis use. The total harm cause might also look different for more vulnerable subgroups like adolescents and young adults.(7)

Table 20 Variables used to estimate the impact of legalization of cannabis in Vermont, adapted from (7)

Current cannabis use in Vermont and in United States	• Self-reported prevalence of cannabis use in past month and annual use-days, by age (12+ and 18+ years) • High school student use in past month and ten or more days in past month • Cannabis-related substance use emergency room visits • Change in use between surveys (%) • Amount consumed per day of use (grams) for daily and near daily users • Distribution of days of use per past-month user • Estimated price elasticity of cannabis
Criminal and civil enforcement costs	• Changes in sanctions and fines for cannabis offenses in Vermont over time • Number of cannabis-related offenses over time, by age (<21 years and 21+ years) • Criminal justice resources required for each offense • Change in criminal and civil cases before and after decriminalization
Impact on use of other substances	• No clear method or variables to calculate this effect • Greater cannabis use is thought to lead to greater tobacco use • No clear effect for alcohol, prescription opioids or illegal drugs

The RAND Corporation report on the legalization of cannabis in Vermont provided some estimate of the potential diversion of buyers from black market suppliers based on pricing (Figure 21) and the potential change in consumption with the legalization of cannabis in Vermont (Figure 22).

Legal Supply's Market Share as a Function of Its Price Premium, Based on the Washington Cannabis Consumption Survey
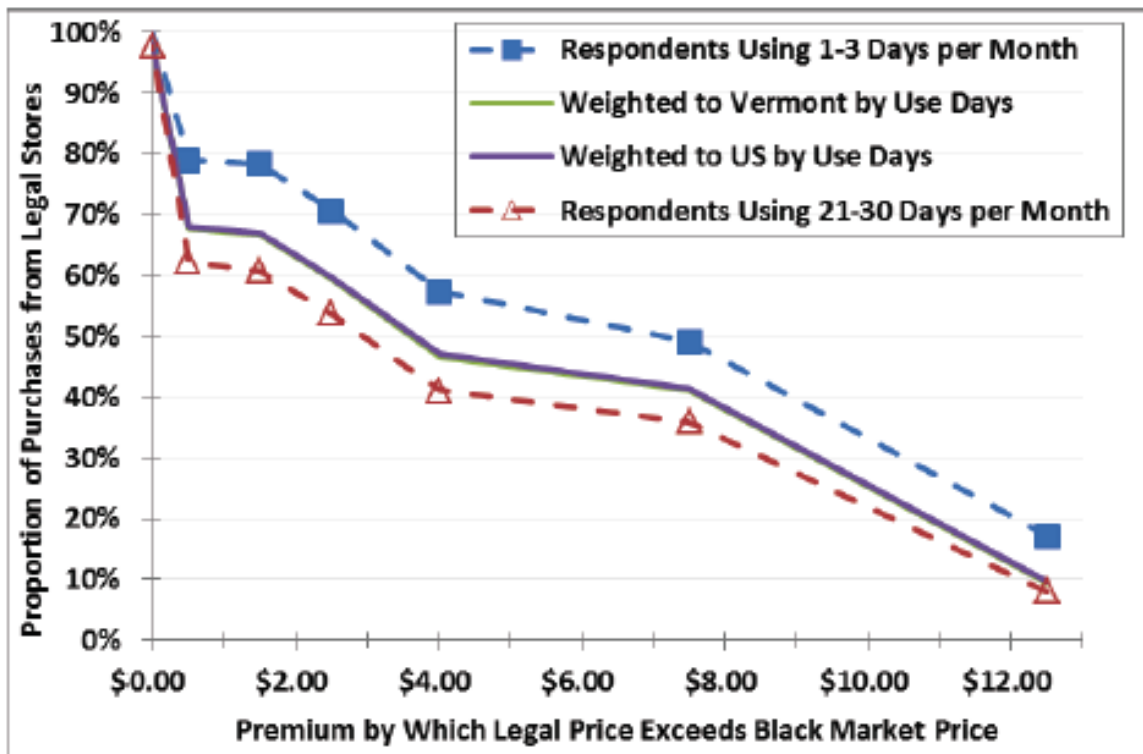
SOURCE: Analysis of CCS data.

NOTE: The two weighted averages (solid lines) are in between and lie on top of each other to such an extent that they look like one line.

Figure 21 Relationship between premium for legal cannabis and proportion of cannabis purchased through legal means, taken directly from (7)

Distribution of Increases in Consumption Produced by Simulation
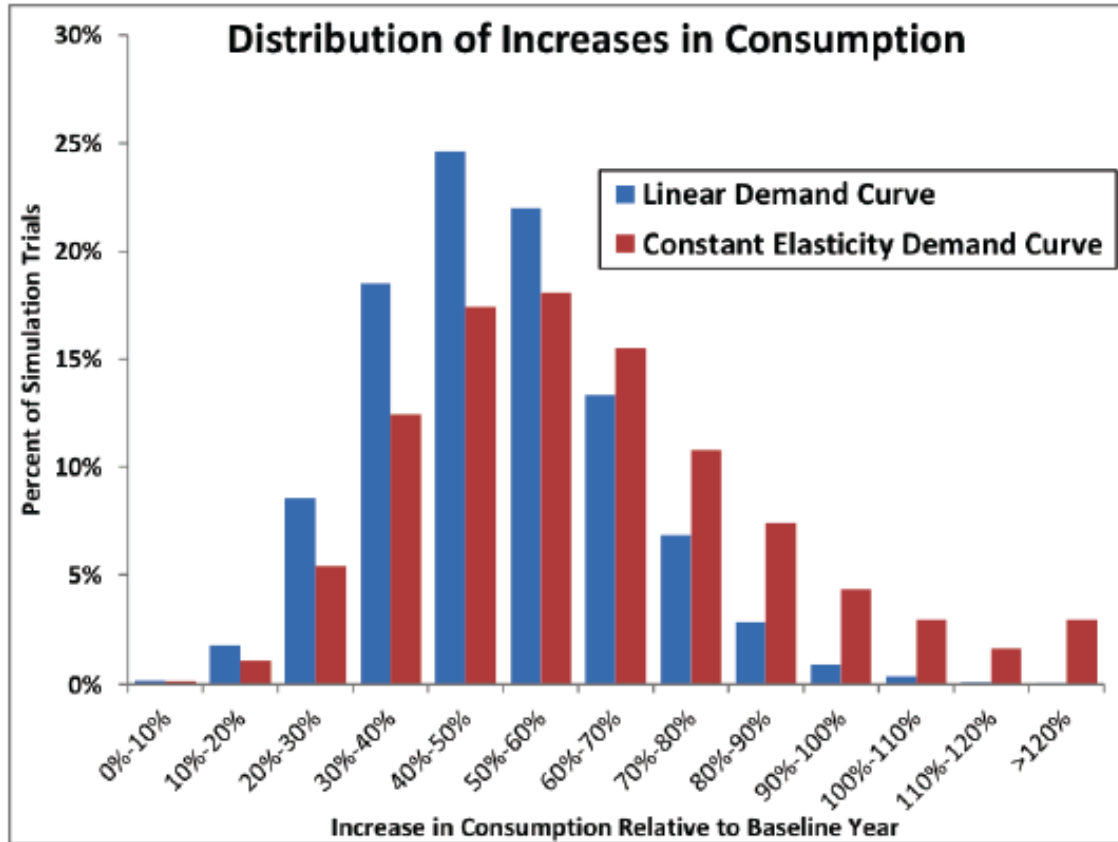

Figure 22 Monte Carlo simulation of increase in cannabis consumption with legalization in Vermont, taken directly from (7)