

Analysis of drivers of the illicit cannabis market

**FINDINGS FROM THE INTERNATIONAL CANNABIS
POLICY STUDY: 2019 – 2020.**

**DAVID HAMMOND ^{PhD}, VICKI RYNARD ^{MSc}, ELLE
WADSWORTH ^{PhD}, SAMANTHA GOODMAN ^{PhD}**

SEPTEMBER 2021



**UNIVERSITY OF
WATERLOO**

FUNDING

THIS REPORT WAS PREPARED ON BEHALF OF PUBLIC SAFETY CANADA.

SUGGESTED CITATION

HAMMOND D, RYNARD V, WADSWORTH E, GOODMAN S. ANALYSIS OF DRIVERS OF THE ILLICIT CANNABIS MARKET: FINDINGS FROM THE INTERNATIONAL CANNABIS POLICY STUDY: 2019 – 2020. UNIVERSITY OF WATERLOO; WATERLOO, ON, CANADA. SEPTEMBER 2021.

CONTACT

DAVID HAMMOND PhD
PROFESSOR
SCHOOL OF PUBLIC HEALTH & HEALTH SYSTEMS
UNIVERSITY OF WATERLOO
TEL. 519 888 4567 EXT. 46462
EMAIL. DHAMMOND@UWATERLOO.CA
WWW.CANNABISPROJECT.CA



UNIVERSITY OF
WATERLOO

FACULTY OF HEALTH
School of Public Health
and Health Systems

EXECUTIVE SUMMARY

Reducing the illegal cannabis market is among the primary objectives of the Cannabis Act. The current analysis examined factors associated with purchasing cannabis from legal retail sources in the first 24-months following legalization of non-medical cannabis in Canada. Data were from the International Cannabis Policy Study (ICPS), which consists of annual population-based surveys of cannabis use. The analysis included repeat-cross sectional findings from the 2019 and 2020 ICPS surveys, with a Canadian sample of past 12-month cannabis consumers, aged 21 to 65 years-old. An iterative modelling approach was used to examine differences in legal purchasing by province (Model 1), price of dried flower (Model 2), retail accessibility (Model 3), and consumer perceptions of legal versus illegal cannabis with respect to convenience, price, product quality, safety to use, and safety to buy (Model 4). Each model examined three different outcomes: the *percentage of dried flower* purchased from a legal source in the last 12-months (Outcome 1); the *percentage of all cannabis products* purchased from a legal source in the last 12-months (Outcome 2); and the percentage of dried flower consumers who reported purchasing from a legal retail source *at last purchase* (Outcome 3). In addition, descriptive statistics examined the percentage of legal purchases in the past 12-months for eight separate product categories: orally ingested oils, vaping liquids/oils, edibles, drinks, solid concentrates, hash/kief, tinctures, and topical ointments. Descriptive statistics also examined *reasons for purchasing cannabis* from illegal sources among consumers who had done so in the past 12-months.

The findings suggest that time since legalization is the most important determinant of the transition to legal sources of cannabis in a regulated market. On every indicator examined, consumers were substantially more likely to report purchasing cannabis from legal sources in 2020 compared to 2019. ‘Convenience’ and retail accessibility—analysed as the number of retail stores per capita in each province, and individual distance from a legal store—also emerged as an important factor associated with legal purchases. Price and perceptions of cost were also associated with legal purchases, but to a lesser extent. Perceptions of product quality, which is influenced by a range of factors, was also associated with legal purchases.

The analysis suggests that the relative importance of these factors changes over time as the legal retail market evolves. Retail accessibility was associated with legal purchasing in both years, but the effect was stronger in 2019, when disparities in retail accessibility were at their greatest. In addition, provincial differences in price explained little or no variation in legal purchasing in 2019, but were more significant in 2020.

Purchasing cannabis from legal sources also differed by individual-level sociodemographic factors. In particular, daily consumers were less likely to purchase cannabis from legal sources compared to less frequent consumers. This is notable given that daily consumers account for the vast majority of cannabis consumed in Canada. Legal purchases were also lower among potentially marginalized groups, including 'non-white' consumers and those with low education and income adequacy. Despite differences in legal purchases across these sociodemographic factors, it is notable that legal purchases increased from 12 to 24-months after legalization among virtually all population subgroups.

Overall, the findings highlight that no single factor accounts for the consumer decision to purchase from a legal versus illegal source, and the relative influence of factors shifts over time. The cannabis market in Canada has continued to evolve since the current data were collected in 2020, including marked reductions in retail price and increases in the number of legal stores in many provinces. These changes are likely to have accelerated the transition to the legal market and warrant further examination. Finally, the impact of the COVID19 pandemic should be considered when interpreting changes in the cannabis market between 2019 and 2020.

Table of contents

EXECUTIVE SUMMARY	3
BACKGROUND	6
METHODS	7
Data source.....	7
Measures	8
Analysis.....	13
RESULTS	16
Study sample characteristics	16
Descriptive estimates of legal purchasing.....	18
Model 1: Estimating the association between province, sociodemographic variables, and purchasing canabis from legal sources	26
Model 2: Estimating the association between dried flower prices and purchasing from legal sources	29
Model 3: Estimating the association between retail stores per capita, proximity to legal stores, and purchasing from legal sources.....	30
Model 3a—Retail stores per capita	30
Model 3b—Distance from a legal retail store	33
Model 4: Estimating the association between consumer perceptions of price, convenience, quality & safety and purchasing from legal sources	35
Reasons for purchasing illicit cannabis	37
DISCUSSION	38
LIMITATIONS	43
SUMMARY	46
APPENDIX	48
Appendix A: Model 1 output (Province)	48
Appendix B: Model 2 output (Price)	54
Appendix C: Model 3a output (Retail stores per capita)	60
Appendix D: Model 3b output (Distance to legal store)	66
Appendix E: Model 4: Output (Consumer perceptions)	72
REFERENCES	78

BACKGROUND

Transitioning consumers from illegal to legal sources of cannabis is a primary objective of the Cannabis Act.¹ In 2017, Canadians spent an estimated \$6 billion CAD on cannabis, of which an estimated 90% was from illegal sources.² Prior to legalization, illegal cannabis was widely available in Canada and could be accessed through street dealers, dispensaries and online retail sources.^{3,4} Illegal cannabis has the potential to undermine the impact of several core policy measures under legalization, including product standards, product labelling and health warnings, minimum legal age (MLA), and other measures to reduce consumption by youth. Illegal cannabis also undermines price controls and government revenue from taxation.⁵

Estimating the size of illegal markets presents considerable challenges.⁶ Data on seizures of illegal cannabis or the number of cannabis offences are more a reflection of the level of enforcement activity than the scope of the illegal market.^{7,8,9} For example, in 2015, only \$13.3 million worth of cannabis was seized in Canada, from an illegal market estimated at \$5 billion.⁶ The utility of these indicators is even lower during the transition to a regulated legal market. Therefore, population-level surveys are often used to estimate the size of the illegal cannabis market, using self-reported data on cannabis purchasing and consumption.⁷

A range of factors influence consumer decisions to purchase from illegal sources in jurisdictions that have legalized non-medical cannabis. Factors include age (e.g., those below the MLA), sex, established relationships with dealers, and a reluctance to buy from government stores out of a desire to remain anonymous.^{10,11} However, the overall demand for illegal cannabis in a regulated market is primarily dictated by three factors: price, retail availability, and product ‘quality’.

Price plays a central role in economic theories of consumer behaviour.^{12,13,14} ‘Price elasticity’ is the economic concept that explains how changes in price affect consumer demand and is operationalized as the proportion that consumption decreases for a given price increase. Some studies suggest that higher cannabis prices are associated with lower cannabis consumption; however, there are insufficient data to reliably estimate the price elasticity of cannabis.¹⁵

The retail availability of consumer goods has a direct influence on consumer demand for both legal and illegal products.¹⁶ Under legalization, dried flower and some oils were available in October 2018; all other products, including edibles and concentrates, were available for sale from legal sources in Dec 2019/Jan 2020.^{17,18} Under the Cannabis Act, provinces have jurisdiction over the retail policies, including the number and location of stores. As a result, the number of stores per capita varied substantially between provinces over the first two years of legalization.¹⁹ Retail proximity can influence the overall consumption of products, including cannabis, as well as the likelihood that consumers purchase from legal versus illegal retail sources.^{16, 20,21,22,23,24} Therefore,

differences in the number and retail density of stores between provinces has the potential to influence both the transition to the legal market and overall consumption.

The illegal market may also depend on other factors, including sociodemographic characteristics and frequency of use. For example, in the 2019 National Cannabis Survey, respondents aged 65 and older were less likely to report obtaining cannabis illegally than younger consumers.^{25,26} In the 2020 Canadian Cannabis Survey, a lower percentage of female cannabis consumers reported “always or “mostly” obtaining cannabis from illegal sources than male cannabis consumers.⁵⁰ There is relatively little evidence on the importance of cannabis frequency and purchasing from legal versus illegal sources. Frequent consumers may be more price sensitive and thus, may be less likely to transition to the legal market if they perceive cannabis from illegal sources to be less expensive.

Overall, to date, there are few estimates of these factors, including in the Canadian market. The primary objective of the current analysis was to examine different factors associated with purchasing cannabis from illegal retail sources in Canada in the first two years since legalization of non-medical cannabis.

METHODS

Data source

Data are cross-sectional findings from Canadian respondents from two annual waves of the International Cannabis Policy Study (ICPS).²⁷ Respondents aged 16-65 were recruited through the Nielsen Consumer Insights Global Panel and their partners’ panels. Email invitations (with a unique link) were sent to a random sample of panelists (after targeting for age and country criteria); panelists known to be ineligible were not invited. Data were collected via self-completed web-based surveys conducted in 2019 (September 13 to October 31) and 2020 (September 3 to November 2). Surveys were conducted in English in the US and English or French in Canada. Median survey time was 25 min in 2019 and 21 min in 2020. Technical reports for the ICPS surveys provide additional methodological description (see <http://cannabisproject.ca/methods/>).

SAMPLE

Respondents were eligible to participate in the ICPS surveys if they resided in a Canadian province, were 16-65 years of age at the time of recruitment, and had access to the internet. Respondents below the age of 21 were excluded from the current analysis based on the minimum legal age of 21 in Quebec, and the fact that all respondents below the minimum legal age who purchase cannabis are not legal, regardless of source. To avoid different age profiles across provinces with different

minimum legal age regulations, respondents below 21 years of age were excluded from all provinces.

ICPS respondents were recruited using non-probability sampling methods through the Nielsen Consumer Insights Global Panel and their partners' panels, which maintains panels in Canada and the US. Respondents were provided with information about the study and provided consent prior to completing the survey. Respondents received remuneration in accordance with their panel's usual incentive structure (e.g., points-based or monetary rewards, chances to win prizes). In 2019, 81,263 respondents accessed the survey link, of whom 51,087 completed the entire survey for an AAPOR cooperation rate of 62.9%. In 2020, 78,438 respondents accessed the survey link, of whom 48,633 completed the entire survey for an AAPOR cooperation rate of 62.0%. Comparisons between the ICPS study sample and versus census estimates and other national surveys is provided in the ICPS Technical Report.^{28,29} The study was reviewed by and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE# 22392).

The current analysis only included past 12-month cannabis consumers from Canada. The sociodemographic profile of the study sample is provided in the Results section (see Table 1).

Measures

The full ICPS surveys for 2019 and 2020 are publicly available (see www.cannabisproject.ca). Survey measures were drawn or adapted from national surveys or selected based on previous research. To develop and test the survey measures, a pilot survey of 870 youth and young adults was conducted in October 2017. To examine the comprehension of measures, focus groups and cognitive interviews were conducted in January-February 2018 and August 2019. In all cases, respondents had the option of selecting 'Don't Know' or 'Refuse'. In all variables except "perceived income adequacy", "Refuse to answer" was treated as missing. In all variables except "perceived income adequacy", "purchase source at last purchase", and "self-reported time to nearest store", "Don't know" was treated as missing.

ESTIMATES OF LEGAL PURCHASE SOURCES

Legal versus illegal cannabis purchases were self-reported by ICPS survey participants using two types of questions based on 'last purchase source' and 'percentage of all products from legal/authorized sources in the past 12-months'. Each of these measures is described below:

Last purchase source

Respondents who purchased dried flower in the past 12 months were asked "The last time you bought dried flower, where did you buy it", with answers: "From a family member or friend", "From a dealer (in person)", "Internet delivery service or mail order", "From a store, cooperative or dispensary (in person)", "Other". Illegal and legal physical stores and online stores were determined by follow-up questions: "What type of physical store or dispensary did you buy the

dried flower from?” with answers: “A legal/authorized store”, “An illegal or unauthorized store/dispensary”, “Other” and “Where did you buy the dried flower online?” with answers: “An authorized/legal website”, “An unauthorized/illegal website, private delivery service or dealer”, “Other”. “Other” responses were re-categorized according to answers provided.*

Percentage of product consumed from legal/authorized source

In 2019 and 2020, respondents who consumed cannabis in the past 12 months were asked: “Overall, how much of the marijuana that you used in the past 12 months was purchased from LEGAL/AUTHORIZED sources?” Answers were open-ended from 0%-100%. The same question was asked of consumers for each specific product type that was consumed: “Overall, about what percentage of the [product type] that you used in the past 12 months came from LEGAL/AUTHORIZED sources?” This question was asked in reference to nine specific product types: dried flower, orally ingested oils (drops or capsules), vape oil, edibles, drinks, solid concentrates, hash or kief, tinctures, and topical ointments.

National and provincial estimates of legal purchasing were adjusted for consumers’ consumption amounts based on frequency of use (see Figures 1-3. Previous analyses of ICPS consumption data indicate that daily/almost daily consumers account for an estimated 87% of all dried flower consumed in the Canadian market, compared to 9.7% among weekly consumers, 3.0% among monthly consumers, and 0.3% among less than monthly consumers.³⁰ Accordingly, consumers received a weight based on their frequency of use in addition to the post-stratification survey weights. These estimates will have greater correspondence to sales-weighted estimates based on retail sales.

PROVINCIAL-LEVEL CANNABIS PRICES

Cannabis prices are the result of several factors, including wholesale prices from manufacturers, tax rates, and retail prices set by retailers, including both ‘private’ retailers and government-run retail outlets in several Canadian provinces. Cannabis prices can be estimated using various methods, including direct assessment of prices in retail stores or self-reported data from survey participants on the price during their last purchase.

ICPS Cannabis Retail Scan

A scan of legal and illegal cannabis retail outlets was conducted between September and October 2019, and between March and May 2020. Legal cannabis stores in Canada were identified using official provincial and territorial government websites. Data were manually collected from all government-run online stores. Data from the menus of privately-owned storefronts listed on Leafly were collected using a web scraper. The stores captured via the Leafly web scraper were compared to the government lists of legal cannabis stores in each province/territory. Any private retailers that were not captured via Leafly were then captured manually by accessing each retailer’s website.

* In the interests of brevity, ‘legal/authorized sources’ will be shortened to ‘legal’ sources throughout the report.

If a private retailer had multiple storefronts in one province/territory, data were manually collected from the storefront with the largest product selection, as it was assumed pricing would not vary between storefronts of the same retailer within a province/territory.

Data were manually collected on all products available at the Ontario Cannabis Store (OCS) and Société Québécoise du Cannabis (SQDC)—the government-run online stores in Canada’s two largest provinces. For all other government-run online stores, data on the least expensive, most expensive, and a random sample of products within each product category were manually collected. The number of products randomly sampled varied by product category. Fifty whole flower products, 20 pre-rolls, 20 oils containing THC, and 10 CBD oils with low THC content were randomly sampled. For the five provinces and territories in which online stores and storefronts were both government-run, online pricing was identical to pricing at storefronts. Data were collected on all products available at private retailers and illegal retailers. The addresses and websites of the physical storefronts and online stores were collected, respectively. Product price, purchase quantity, THC levels, and CBD levels were collected from each store accessible online. The final dataset contained 184,131 products (68,158 collected in Sept-Oct 2019 and 115,973 collected in Mar-May 2020).

Based on the price data for dried flower, an average price for each province was calculated using the 10th percentile of the price distribution for each province. The 10th percentile was selected as a proxy for lower priced dried flower on the basis that that availability of less expensive cannabis is more relevant to decisions to purchase from legal versus illegal sources based on price sensitivity.

In all cases, 2019 prices were adjusted for a 0.5% inflation rate to provide comparable estimates with 2020 prices.³¹

Sensitivity analyses

As described above, price data was modelled based on the 10th percentile of prices for the dried flower in each province. Sensitivity analyses were also conducted using the mean and median prices within each province. The pattern of findings was highly consistent, although significance levels for the price variable were moderately lower than for the 10th percentile variable.

Sensitivity analyses were also conducted using estimates of provincial prices from several data sources. This is important given that data sources have produced notably different price estimates, including relative price differences across provinces. These inconsistencies reflect discrepant methodologies used across studies, as well as differences in the dates during which price data was collected. The specific dates of data collection are particularly important given rapidly evolving legal prices of cannabis during the first 24 months after legalization in Canada.

Due to the different prices estimates across different studies, we collected and modelled estimates of prices from two additional sources.[†] Models were run using provincial ‘webscraped’ data published by Leafly for October 2019.³² Models were also run using data collected for the same dried flower product in each province (Aurora 3.5g dried flower). Both the Leafly and Aurora data were only available for 2019; accordingly, these models only included 2019 ICPS survey data. Despite modest differences between these models and the reported model using the 10th percentile data from the Cannabis Retail Scan, the general findings were similar with respect to whether the price variable was significant and the direction of the association.

RETAIL AVAILABILITY AND PROXIMITY

Two measures of retail access were examined, each of which is described below.

Retail stores per capita-provincial level

First, legal retail stores per capita were calculated for each province. Data was collected at two times point (September 2019 and September 2020) to coincide with ICPS survey data collection. Briefly, legal retailers in each province were identified and downloaded from provincial websites in September 2019 and cross-checked with lists displayed on Leafly, a website dedicated to cannabis and legal cannabis stores (www.leafly.ca).^{33,34} The number of stores in each province was divided by the provincial population aged 15 and over for 2019 and multiplied by 100,000.³⁵ Illegal retail stores were not included. A table of this data is shown in the Results section in Table 6.

Distance to legal retail stores-respondent level

The second measure examined was each respondents’ proximity to a legal ‘brick-and-mortar’ store by calculating Euclidian distance based on postal code. Respondents were asked “Please provide the postal code where you live for most of the year”. In 2019, a total of 2,900 respondents at Wave 2 either didn’t know their postal code (n=1,175), refused to provide their postal code (n=1,676), or their postal code did not match their province (n=49). If respondents answered, ‘Don’t know’ or ‘Refuse to answer’, they were given an opportunity to provide their intersection of residence. Those respondents were asked “Please name the 2 cross-streets of this intersection”. Respondents were given the option of ‘Don’t know’ (n=581) or ‘Refuse to answer’ (n=1,189) for the intersection. Of those who provided their intersection (n=1,081), Google Maps was used to obtain postal codes, cross-referencing with the respondent’s city and province. If Google Maps did not recognize the intersection, each street name was entered individually to clarify. All intersections where Google

[†]Although the Canadian Cannabis Survey estimate self-reported price of dried flower, the survey does not distinguish between purchases from ‘legal’ and ‘illegal’ sources. Given that cannabis from illegal sources was substantially less expensive in the period immediately following legalization, CCS estimates across provinces are confounded by the prevalence of illegal purchasing in different provinces.^{†,†} The ICPS surveys also estimate price of dried flower at last purchase, as well as whether the source from a legal/authorized source. However, the sample sizes in several provinces are inadequate to provide robust estimates across each province as required for the current analysis.

Maps could not find a postal code were left blank (n=272). A total of 809 postal codes were retrieved. The same process was applied to data cleaning of 2020 data.

The postal codes of legal retailers in each province were identified using provincial websites and cross-checked with lists from Leafly. The Canadian respondents' postal codes and postal codes of legal retail stores were linked to the Postal Code Conversion File Plus (PCCF+), version 7B to obtain latitude and longitudes.³⁶ Postal codes of legal retail stores in Canada were also linked to the PCCF+ v7B to obtain latitudes and longitudes. The postal codes were assigned 'residential' status; however, the postal codes were assigned 'institutional' as a sensitivity analysis and results were largely identical. An open-source geographic information system (GIS) application (QGIS v3.6) was used to geocode the latitudes and longitudes of legal retail stores and respondents' postal codes. For respondents in urban areas, Canadian postal codes can cover a single house/apartment building, whereas postal codes in rural areas cover a larger landmass. In analyses using 2019 data, 88% of respondents lived in urban areas and so a certain degree of accuracy could be assumed from postal codes as a proxy for Canadian respondent locations.^{37,38}

The North American Equidistant Conic Projection (EPSG:102010) was used to minimize distance distortions. The Euclidean distance between the postal code of the legal retail store and the respondents address were computed and standardized into kilometers (km). Distances were categorized into: "Under 3 km", "3-4.99 km", "5-9.99 km", "10 km and over" to mimic categories used by Statistics Canada.³⁹ Sensitivity analyses were conducted to examine the effect of distance as a categorical measure using breaks at the quartiles as well as a continuous measure.⁴⁰ A summary of this data is shown in the Results section in Table 7.

CONSUMER PERCEPTIONS OF ILLEGAL CANNABIS PRODUCTS

Models examining consumer perceptions provide an alternative approach to understanding factors that influence consumer purchasing decisions. ICPS respondents were asked their perceptions of legal versus illegal cannabis: "We would like to know how marijuana products from legal/authorized sources compare to marijuana products from illegal/unauthorized sources." Respondents rated the following factors: Quality of legal marijuana (Higher quality/No difference/Lower quality/Unstated); Price of legal marijuana (More expensive/No difference/Less expensive/Unstated); Convenience of buying legal marijuana (More convenient to buy/No difference/Less convenient to buy/Unstated); Safety of using legal marijuana (Safer to use/No difference/Less safe to use/Unstated); Safety of buying legal marijuana (Safer to buy/No difference/Less safe to buy/Unstated). A summary of this data is shown in the Results section in Table 8.

Additional perception data was collected from ICPS respondents who indicated that they had obtained cannabis from illegal sources (i.e., consumers who reported purchasing <100% of

cannabis from legal/authorized sources in the past 12 months). These respondents were asked, “What were the main reasons you bought from illegal/unauthorized sources instead of legal/authorized sources? Select all that apply” followed by a list of 16 response options (see Results section, Table 9). These data were not modelled as a predictor of legal purchasing given that they were only asked of those who reported purchasing from illegal sources; however, descriptive statistics are provided for context.

SOCIODEMOGRAPHIC CHARACTERISTICS

Socio-demographic measures included sex at birth (Male, Female), age in years (21-35, 36-45, 46-55, 56-65). Ethnicity/race was assessed using census measures and categorized as ‘White’, ‘Non-white (including Black, East/Southeast Asian, Indigenous, Latinx, Middle Eastern, South Asian), and ‘Other/Mixed’. Other sociodemographic measures included highest level of education (Less than high school, High school diploma, Some college or technical vocation, Bachelor’s degree or higher), perceived income adequacy (Very difficult/Difficult, Neither easy nor difficult, Easy/Very easy, Not reported). A table summarizing the sample profile is provided in Results section (see Table 1).

GEOGRAPHIC LOCATION- URBAN VS. RURAL STATUS

The ICPS survey collected data on province of residence, city, and postal code or nearest street intersection. This information was used to classify respondents as living in either a Rural or Urban area. Respondents where ‘Rural’ or ‘Urban’ could not be assigned were classified as ‘Missing’.

CANNABIS USE FREQUENCY

Frequency of cannabis use was assessed among past 12-month cannabis consumers and analyzed into the following four exclusive categories: “Less than monthly consumer”, “Monthly consumer”, “Weekly consumer”, “Daily/almost daily consumer”. For the purpose of this report ‘daily/almost daily’ consumers will be referred to as ‘daily’ consumers.

Analysis

All analyses were conducted using post-stratification weights calculated for Canadian respondents. Post-stratification sample weights were constructed based on the Canadian Census estimates. A raking algorithm was applied to the cross-sectional analytic samples to compute weights that were calibrated to these groupings. Weights were rescaled to the sample size for Canada. See the ICPS Technical Reports for further detail (www.cannabisproject.ca/methods). Estimates are weighted unless otherwise specified.

MODEL OUTCOMES

Data are reported for four separate outcomes related to legal cannabis purchasing:

Outcome 1) The percentage of dried flower purchased from a legal source in the last 12-months;

Outcome 2) the percentage of all cannabis products purchased from a legal source in the last 12-months;

Outcome 3) the percentage of dried flower consumers who reported purchasing from a legal retail source at last purchase; and

Outcome 4) the percentage of specific non-flower products purchased in the last 12-months, for each of the following eight product categories: orally ingested oils, vape oil, edibles, drinks, solid concentrates, hash or kief, tinctures, and topical ointments.

Statistical models were fit to examine correlates of legal purchasing. Multinomial regression models were fit for Outcomes 1 and 2. Although Outcomes 1 and 2 represent continuous outcomes (from 0 to 100%) the distribution of these variables did not follow a normal distribution due to a high number of responses at either extreme (0% and 100% of purchases from legal sources). As a result, the variables were analyzed as a 3-level outcome using multinomial regression models: 0% purchased from legal sources (“none”), between 1% and 99% purchased from legal sources (“some”), and 100% purchased from legal sources (“all”). Sensitivity analyses were conducted in which each outcome was run using three different types of models: 1) multinomial models using the 3-level outcome variable; 2) 5-level multinomial models to reflect more variability among those who reported purchasing ‘some’ cannabis from legal sources (0%, >0 to 33%, >33% to 66%, >66% to <100%, 100%); and 3) linear regression models using the original continuous outcome (i.e., the percentage reported by the respondent). A comparison of model performance indicated that multinomial models had substantially higher R^2 values versus the linear models, suggesting a better overall fit with the data; R^2 values were similar between the multinomial models, with substantially lower AIC values for the 3-level multinomial model. Most importantly, the pattern of significance for the covariates in the model are highly consistent. For the purpose of streamlining the results, only the 3-level multinomial models are reported for Outcomes 1 and 2. Outcome #3 is a binary variable (legal source at last purchase vs. illegal source at last purchase); accordingly, binary logistic regression models were used.

Note that regression models were not run for Outcome 4 (specific product types other than dried flower) due to lower prevalence of use, resulting in fewer consumers for these products and inadequate sample size and limited statistical power to detect differences in statistical models. Therefore, only descriptive statistics are reported for the percentage of legal purchases of orally ingested oils, vape oil, edibles, drinks, solid concentrates, hash or kief, tinctures, and topical ointments.

In the Results section, Outcome 1 represents the primary focus for interpretation, on the basis that the percentage of dried flower purchased in the past 12 months is more specific and more likely to elicit accurate responses compared to questions asking about ‘all cannabis products’, and on the basis that dried flower is the most prevalent cannabis product and accounts for a majority of legal cannabis sales to date.^{30,41,42}

COVARITES INCLUDED IN MODELS

Unless otherwise noted, the following variables were included in all models: age, sex at birth, highest level of education, race/ethnicity, income adequacy, urban/rural location, province of residence, survey year, and frequency of cannabis use. An indicator variable representing the type of device (tablet, computer, or smartphone) was also included in models to adjust for potential differences in screen size and reporting. Due to small sample sizes in Prince Edward Island (PEI), PEI and New Brunswick were combined in models that included province as a variable. In addition to their geographic proximity, PEI and New Brunswick had a similar number of retail stores per capita and both provinces have 'public' or government-run retail stores.

Additional variables were added to examine the influence of several provincial level factors in an iterative fashion:

- Model 1: Province
- Model 2: Price
- Model 3: Retail availability
- Model 4: Consumer perceptions

Regression models were run in two steps: first, a model with only 'main effects' variables were run; in the second step, two-way interactions between survey year and each of the other main effects were added to the model to test for potential differences across years. Adjusted odds ratios (AORs) are reported with 95% confidence intervals (95% CI) in all cases unless otherwise noted. The F likelihood ratio value and degrees of freedom are reported for all models, along with Akaike's Information Criteria (AIC) values and max-rescaled R-square (R^2) as indicators of model fit and performance. Analyses were conducted using survey procedures in SAS (SAS version 9.4, SAS Institute Inc., Cary, NC, USA).

RESULTS

STUDY SAMPLE CHARACTERISTICS

Table 1 shows the profile of cannabis consumers included in the ICPS dataset, as well as subsamples with respect to the three primary outcomes examined in current analysis.

TABLE 1. SAMPLE CHARACTERISTICS BY OUTCOME, 2019 AND 2020.

	All past 12 months cannabis consumers (n=9,427)	All past 12 months dried flower consumers (n=6,959)	Dried flower consumers Last purchase model (n=5,142)	Dried flower consumers % legal model (n=5,263)	Cannabis consumers % legal all cannabis model (n=6,827)
Province					
British Columbia	14.7% (1388)	14.8% (1031)	14.4% (739)	14.0% (739)	14.2% (969)
Alberta	12.5% (1180)	12.8% (890)	13.5% (694)	13.5% (711)	13.0% (888)
Saskatchewan	3.2% (305)	3.4% (234)	3.6% (184)	3.3% (172)	3.3% (224)
Manitoba	3.5% (331)	3.8% (262)	3.8% (196)	3.7% (193)	3.5% (241)
Ontario	41.2% (3884)	40.4% (2814)	39.5% (2030)	39.7% (2092)	41.2% (2809)
Quebec	17.6% (1662)	17.5% (1217)	17.8% (916)	18.1% (952)	17.3% (1179)
New Brunswick	2.3% (215)	2.3% (163)	2.3% (120)	2.4% (126)	2.3% (154)
Nova Scotia	3.0% (281)	3.0% (207)	2.9% (150)	3.1% (163)	3.2% (219)
PEI	0.4% (38)	0.4% (31)	0.5% (24)	0.5% (25)	0.4% (31)
Nfld & Labrador	1.5% (144)	1.6% (110)	1.7% (89)	1.7% (90)	1.6% (112)
Frequency of use					
< monthly consumer	29.4% (2774)	25.1% (1744)	15.4% (792)	22.2% (1168)	23.7% (1616)
Monthly consumer	19.2% (1810)	17.3% (1204)	16.6% (856)	17.0% (895)	19.6% (1339)
Weekly consumer	16.7% (1572)	17.8% (1238)	20.3% (1045)	19.0% (1002)	18.8% (1281)
Daily consumer	34.7% (3272)	39.8% (2772)	47.6% (2449)	41.8% (2199)	37.9% (2590)
Sex					
Female	46.0% (4334)	44.1% (3068)	40.9% (2104)	41.5% (2184)	42.9% (2927)
Male	54.0% (5094)	55.9% (3891)	59.1% (3038)	58.5% (3079)	57.1% (3900)

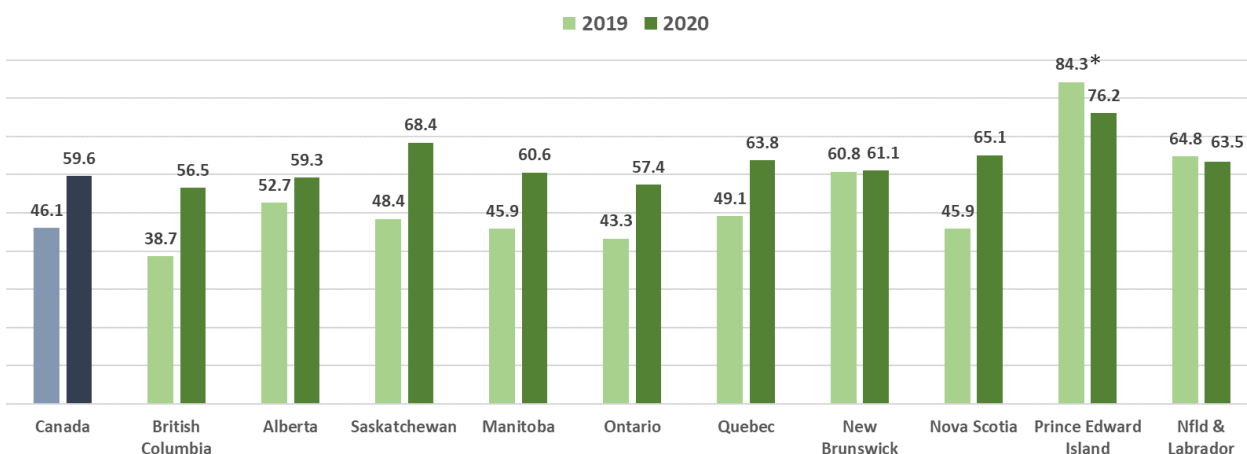
	All past 12 months cannabis consumers (n=9,427)	All past 12 months dried flower consumers (n=6,959)	Dried flower consumers Last purchase model (n=5,142)	Dried flower consumers % legal model (n=5,263)	Cannabis consumers % legal all cannabis model (n=6,827)
Age					
21-35	40.2% (3794)	41.7% (2904)	43.0% (2212)	40.9% (2151)	40.4% (2761)
36-45	23.9% (2256)	24.1% (1675)	25.0% (1285)	24.5% (1289)	24.5% (1670)
46-55	19.4% (1832)	19.0% (1320)	18.8% (965)	18.7% (983)	18.8% (1286)
56-65	16.4% (1546)	15.2% (1060)	13.2% (679)	16.0% (840)	16.3% (1110)
Ethnicity/Race					
Black	3.9% (372)	3.2% (223)	3.2% (165)	2.7% (140)	3.8% (263)
East/Southeast Asian	4.8% (455)	4.5% (311)	4.2% (216)	4.2% (220)	5.0% (339)
Indigenous	3.2% (298)	3.2% (220)	3.6% (186)	2.9% (154)	2.9% (195)
Latinx,	1.6% (155)	1.7% (115)	1.9% (99)	1.8% (95)	1.8% (119)
Middle Eastern,	1.0% (93)	0.9% (60)	0.9% (46)	0.8% (43)	0.9% (61)
South Asian	2.7% (259)	2.6% (178)	2.8% (142)	2.6% (139)	2.9% (199)
White	76.3% (7195)	77.9% (5422)	77.2% (3968)	79.2% (4166)	76.8% (5242)
Other/Mixed	6.4% (600)	6.2% (430)	6.2% (321)	5.8% (305)	6.0% (408)
Education					
< high school	10.7% (1005)	10.7% (742)	11.2% (578)	9.8% (518)	9.2% (628)
High school	28.1% (2647)	30.2% (2100)	30.8% (1582)	29.0% (1528)	27.5% (1879)
Some college	36.9% (3483)	36.7% (2551)	36.5% (1879)	37.7% (1982)	37.8% (2578)
Bachelor's degree	24.3% (2291)	22.5% (1566)	21.4% (1103)	23.5% (1235)	25.5% (1742)
Income adequacy					
Very difficult/Difficult	33.6% (3164)	34.7% (2416)	35.2% (1810)	35.2% (1852)	33.2% (2265)
Neither easy nor difficult	35.4% (3337)	34.9% (2430)	35.1% (1807)	34.3% (1808)	35.3% (2412)
Easy/Very easy	29.0% (2734)	28.3% (1973)	27.9% (1434)	29.0% (1529)	29.9% (2043)
Not reported	2.0% (193)	2.0% (141)	1.8% (91)	1.4% (75)	1.6% (107)
Rural vs. urban					
Urban	75.4% (7109)	76.6% (5331)	77.5% (3986)	78.7% (4140)	77.5% (5292)
Rural	9.1% (858)	9.1% (634)	8.9% (456)	9.8% (517)	9.3% (633)
Missing	15.5% (1460)	14.3% (995)	13.6% (700)	11.5% (606)	13.2% (901)

DESCRIPTIVE ESTIMATES OF LEGAL PURCHASING

DRIED FLOWER

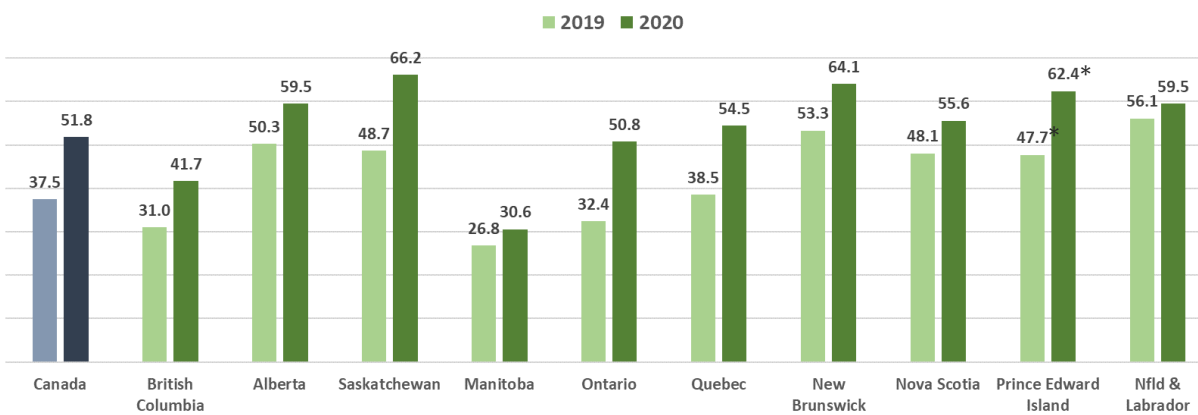
Figures 1-2 show the data for the percentage of dried flower that was purchased from legal sources in the past 12-months (Figure 1) and the percentage who purchased dried flower from a legal source at last purchase (Figure 2).

FIGURE 1. PERCENTAGE OF ALL DRIED FLOWER PURCHASED IN LAST 12-MONTHS FROM A LEGAL RETAIL SOURCE, AMONG RESPONDENTS WHO REPORTED PURCHASING DRIED FLOWER AND ADJUSTED FOR CONSUMPTION AMOUNT. (OUTCOME 1, N=5,263)



*Based on <30 respondents (unweighted) in the denominator; Interpret with caution.

FIGURE 2. PERCENTAGE CONSUMERS WHO REPORTED PURCHASING DRIED FLOWER FROM A LEGAL RETAIL SOURCE AT LAST PURCHASE, AMONG RESPONDENTS WHO REPORTED PURCHASING DRIED FLOWER AND ADJUSTED FOR CONSUMPTION AMOUNT. (OUTCOME 3, N=5,142)

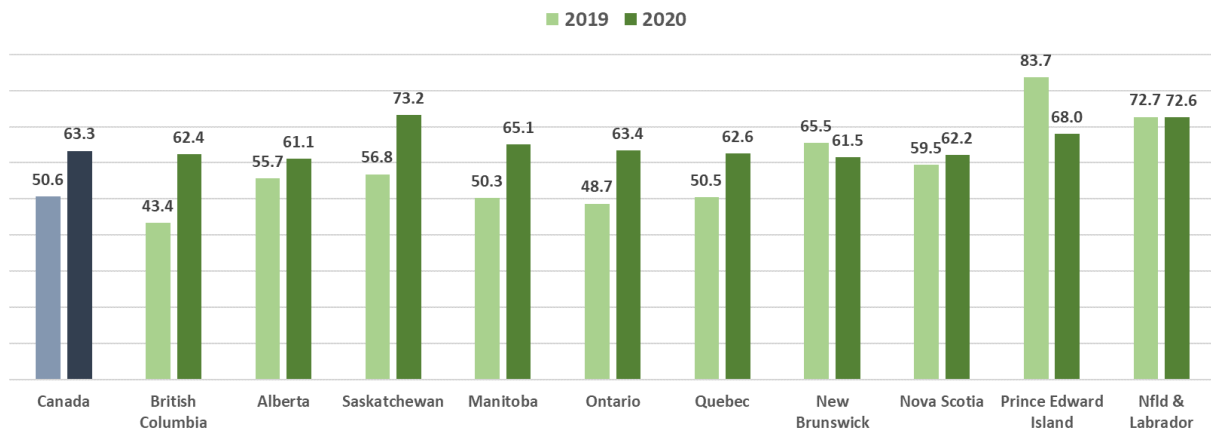


*Based on <30 respondents (unweighted) in the denominator; Interpret with caution.

ALL CANNABIS PRODUCTS

Figure 3 shows the percentage of 'all cannabis' purchased from a legal sources in the past 12-months, overall and by province for 2019 and 2020.

FIGURE 3. PERCENTAGE OF ALL CANNABIS PRODUCTS PURCHASED IN THE LAST YEAR FROM A LEGAL SOURCE, AMONG RESPONDENTS WHO REPORTED PURCHASING CANNABIS PRODUCTS AND ADJUSTED FOR CONSUMPTION AMOUNT (OUTCOME 2, N=6,827)



DESCRIPTIVE ESTIMATES OF LEGAL PURCHASES BY FREQUENCY OF USE AND SOCIODEMOGRAPHIC FACTORS

Table 2 (see next page) shows each of the three primary outcomes by frequency of cannabis use and sociodemographic factors, adjusting for consumption amounts.

**TABLE 2. ESTIMATES OF LEGAL SOURCES OF DRIED FLOWER AND CANNABIS – BY FREQUENCY
OF USE AND SOCIODEMOGRAPHIC FACTORS IN 2019 AND 2020**

	Outcome 1: % legal of all dried flower purchased from legal source (mean)		Outcome 2: % legal of all cannabis products (mean)		Outcome 3: Last purchase was from legal source (mean)	
	2019 (n=2421)	2020 (n=2332)	2019 (n=3277)	2020 (n=3378)	2019 (n=2634)	2020 (n=2444)
Frequency of use						
< monthly consumer	61.9%	73.8%	69.8%	81.7%	55.7%	67.6%
Monthly consumer	63.4%	71.8%	68.2%	74.0%	56.6%	62.0%
Weekly consumer	57.1%	67.4%	63.8%	73.8%	51.3%	63.9%
Daily consumer	45.3%	59.0%	49.5%	62.5%	36.6%	51.1%
Sex						
Female	45.8%	56.2%	54.0%	62.8%	37.8%	50.7%
Male	46.4%	62.2%	48.3%	63.6%	37.3%	52.7%
Age						
21-35	48.5%	61.5%	50.9%	63.2%	38.8%	54.1%
36-45	48.8%	59.4%	53.4%	61.3%	37.8%	47.2%
46-55	40.2%	57.1%	47.4%	64.4%	32.1%	51.5%
56-65	42.7%	58.5%	49.5%	65.0%	40.2%	55.2%
Ethnicity/Race						
Black	53.5%	52.9%	57.1%	73.3%	40.6%	43.9%
East/Southeast Asian	62.6%	70.3%	71.2%	68.4%	62.1%	47.6%
Indigenous	40.2%	59.0%	51.9%	56.8%	40.0%	41.2%
Latinx	50.2%	52.6%	54.0%	56.3%	23.8%	53.6%
Middle Eastern	80.1%*	57.0%*	73.0%*	83.1%	56.6%*	33.4%*
South Asian	32.0%	54.8%	43.6%	52.7%	29.0%	51.3%
White	46.0%	60.3%	49.6%	63.7%	37.3%	53.9%
Other/Mixed	43.9%	53.2%	49.5%	55.2%	32.7%	40.2%
Education						
< high school	41.2%	55.3%	42.1%	60.9%	29.6%	50.8%
High school	48.4%	58.4%	52.0%	59.6%	37.7%	48.0%
Some college	45.6%	60.4%	50.6%	64.3%	38.8%	54.8%
Bachelor's degree	47.0%	63.6%	56.3%	70.2%	42.5%	54.5%
Income adequacy						
Very difficult/Difficult	43.3%	56.5%	48.1%	61.4%	35.6%	46.7%
Neither easy nor difficult	49.4%	59.2%	53.2%	62.9%	41.6%	51.8%
Easy/Very easy	47.4%	65.2%	53.4%	66.6%	35.5%	60.2%
Not reported	44.6%	52.1%	30.0%	59.4%	36.2%	42.6%
Rural vs. urban						
Urban	44.6%	58.5%	48.4%	62.7%	36.7%	50.7%
Rural	49.8%	58.2%	52.7%	62.7%	41.1%	56.1%
Missing	52.1%	68.8%	60.7%	67.5%	39.7%	55.9%

*Based on <30 respondents (unweighted) in the denominator; Interpret with caution.

DESCRIPTIVE ESTIMATES FOR LEGAL SOURCES OF SPECIFIC CANNABIS PRODUCTS OTHER THAN DRIED FLOWER

Tables 3A to 3I show the percentage of products consumed in the past 12 months that were obtained from legal sources for nine individual product categories: orally-ingested oils, orally-ingested drops, vape oils and liquids, edibles, drinks, solid concentrates, hash or kief, tinctures, and topical ointments.

TABLE 3A. PERCENTAGE OF ORALLY-INGESTED DROPS CONSUMED IN THE LAST YEAR OBTAINED FROM A LEGAL SOURCE – 2020 (n=873)*

Percentage or oral drops from legal sources		
	Unadjusted for frequency of use % (n)	Adjusted for frequency of use % (n)
CANADA	84.0% (873)	79.8% (873)
British Columbia	85.0% (141)	81.7% (141)
Alberta	85.0% (154)	82.7% (154)
Saskatchewan	92.6% (54)	92.0% (54)
Manitoba	90.3% (47)	81.1% (47)
Ontario	85.0% (153)	83.7% (153)
Quebec	77.8% (87)	62.5% (87)
New Brunswick	77.9% (79)	65.8% (79)
Nova Scotia	70.5% (76)	54.9% (76)
Prince Edward Island	100% [†] (20)	100% [†] (20)
Nfld & Labrador	94.2% (62)	88.0% (62)

* Self-reported among consumers who reported purchasing orally-ingested drops in the past 12-months. Unweighted n's are reported.

[†]Based on <30 respondents (unweighted) in the denominator; Interpret with caution.

**TABLE 3B. PERCENTAGE OF ORALLY-INGESTED CAPSULES CONSUMED IN THE
LAST YEAR OBTAINED FROM A LEGAL SOURCE – 2020 (n=410)***

	Percentage of capsules from legal sources	
	Unadjusted for frequency of use % (n)	Adjusted for frequency of use % (n)
CANADA	81.4% (410)	82.4% (410)
British Columbia	78.3% (62)	74.4% (62)
Alberta	87.7% (78)	84.8% (78)
Saskatchewan	92.1% [†] (24)	86.7% [†] (24)
Manitoba	89.2% [†] (23)	86.0% [†] (23)
Ontario	79.4% (89)	85.1% (89)
Quebec	83.3% (39)	86.9% (39)
New Brunswick	68.3% [†] (19)	58.4% [†] (19)
Nova Scotia	65.0% [†] (24)	60.0% [†] (24)
Prince Edward Island	100% [†] (5)	100% [†] (5)
Nfld & Labrador	86.1% (47)	79.9% (47)

* Self-reported among consumers who reported purchasing orally-ingested capsules in the past 12-months. Unweighted n's are reported.

[†]Based on <30 respondents (unweighted) in the denominator; Interpret with caution.

**TABLE 3C. PERCENTAGE OF VAPING OILS & LIQUIDS CONSUMED IN THE
LAST YEAR OBTAINED FROM A LEGAL SOURCE – 2020 (n=655)***

	Percentage of vaping oils & liquids from legal sources	
	Unadjusted for frequency of use % (n)	Adjusted for frequency of use % (n)
CANADA	71.7% (655)	70.3% (655)
British Columbia	71.6% (112)	70.1% (112)
Alberta	76.9% (126)	76.6% (126)
Saskatchewan	75.6% (45)	67.7% (45)
Manitoba	70.5% (38)	76.4% (38)
Ontario	70.7% (136)	70.0% (136)
Quebec	70.3% (48)	64.6% (48)
New Brunswick	65.2% (62)	62.7% (62)
Nova Scotia	66.8% (49)	61.0% (49)
Prince Edward Island	85.5% [†] (5)	82.6% [†] (5)
Nfld & Labrador	68.9% (34)	73.7% (34)

* Self-reported among consumers who reported purchasing vaping oils and liquids in the past 12-months. Unweighted n's are reported.

[†]Based on <30 respondents (unweighted) in the denominator; Interpret with caution.

TABLE 3D. PERCENTAGE OF CANNABIS EDIBLES CONSUMED IN THE LAST YEAR OBTAINED FROM A LEGAL SOURCE – 2020 (n=1,674)*

Percentage of cannabis edibles from legal sources		
	Unadjusted for frequency of use % (n)	Adjusted for frequency of use % (n)
Canada	65.8% (1674)	56.1% (1674)
British Columbia	70.5% (263)	55.5% (236)
Alberta	72.2% (246)	63.5% (283)
Saskatchewan	71.1% (71)	68.9% (73)
Manitoba	68.2% (56)	65.0% (58)
Ontario	64.0% (761)	54.3% (751)
Quebec	49.8% (145)	35.6% (129)
New Brunswick	63.9% (40)	52.7% (50)
Nova Scotia	68.9% (51)	62.5% (59)
Prince Edward Island	66.4% [†] (8)	68.9% [†] (8)
Nfld & Labrador	77.3% (31)	68.9% [†] (25)

* Self-reported among consumers who reported purchasing cannabis edibles in the past 12-months. Unweighted n's are reported.

[†]Based on <30 respondents (unweighted) in the denominator; Interpret with caution.

TABLE 3E. PERCENTAGE OF CANNABIS DRINKS CONSUMED IN THE LAST YEAR OBTAINED FROM A LEGAL SOURCE – 2020 (n=426)*

Percentage of cannabis drinks from legal sources		
	Unadjusted for frequency of use % (n)	Adjusted for frequency of use % (n)
Canada	77.8% (426)	73.6% (426)
British Columbia	72.8% (67)	65.5% (67)
Alberta	85.6% (81)	84.1% (81)
Saskatchewan	91.6% [†] (28)	91.9% [†] (28)
Manitoba	88.0% [†] (23)	78.2% [†] (23)
Ontario	71.9% (99)	67.2% (99)
Quebec	82.6% (48)	83.1% (48)
New Brunswick	71.2% [†] (19)	62.8% [†] (19)
Nova Scotia	86.7% [†] (24)	74.8% [†] (24)
Prince Edward Island	64.5% [†] (4)	19.5% [†] (4)
Nfld & Labrador	94.5% (33)	99.0% (33)

* Self-reported among consumers who reported purchasing cannabis drinks in the past 12-months. Unweighted n's are reported.

[†]Based on <30 respondents (unweighted) in the denominator; Interpret with caution.

TABLE 3F. PERCENTAGE OF 'SOLID' CANNABIS CONCENTRATES CONSUMED IN THE LAST YEAR OBTAINED FROM A LEGAL SOURCE – 2020 (n=355)*

	Percentage of 'solid' cannabis concentrates from legal sources	
	Unadjusted for frequency of use % (n)	Adjusted for frequency of use % (n)
Canada	44.0% (355)	42.1% (355)
British Columbia	40.1% (58)	39.7% (58)
Alberta	45.3% (71)	45.2% (71)
Saskatchewan	50.0% [†] (29)	42.3% [†] (29)
Manitoba	48.3% [†] (20)	42.3% [†] (20)
Ontario	44.9% (75)	44.7% (75)
Quebec	37.8% [†] (28)	32.2% [†] (28)
New Brunswick	51.2% [†] (26)	44.3% [†] (26)
Nova Scotia	38.8% [†] (23)	37.1% [†] (23)
Prince Edward Island	76.9% [†] (3)	76.9% [†] (3)
Nfld & Labrador	50.8% [†] (22)	34.2% [†] (22)

* Self-reported among consumers who reported purchasing 'solid' cannabis concentrates in the past 12-months. Unweighted n's reported.

[†]Based on <30 respondents (unweighted) in the denominator; Interpret with caution.

TABLE 3G. PERCENTAGE OF HASH/KIEF CONSUMED IN THE LAST YEAR OBTAINED FROM A LEGAL SOURCE – 2020 (n=523)*

	Percentage of hash/kief from legal sources	
	Unadjusted for frequency of use % (n)	Adjusted for frequency of use % (n)
Canada	41.2% (523)	41.3% (523)
British Columbia	44.1% (70)	41.8% (70)
Alberta	44.0% (85)	45.8% (85)
Saskatchewan	42.3% (35)	37.4% (35)
Manitoba	43.1% [†] (21)	40.3% [†] (21)
Ontario	43.5% (96)	43.9% (96)
Quebec	35.3% (87)	36.9% (87)
New Brunswick	43.8% (40)	45.3% (40)
Nova Scotia	27.1% (44)	30.7% (44)
Prince Edward Island	92.5% [†] (4)	74.8% [†] (4)
Nfld & Labrador	37.1% (41)	17.2% (41)

* Self-reported among consumers who reported purchasing 'hash/kief' in the past 12-months. Unweighted n's reported.

[†]Based on <30 respondents (unweighted) in the denominator; Interpret with caution.

**TABLE 3H. PERCENTAGE OF CANNABIS TINCTURES CONSUMED IN THE
LAST YEAR OBTAINED FROM A LEGAL SOURCE – 2020 (n=389)***

Percentage of tinctures from legal sources		
	Unadjusted for frequency of use % (n)	Adjusted for frequency of use % (n)
Canada	69.6% (389)	64.5% (389)
British Columbia	72.0% (79)	61.8% (79)
Alberta	58.1% (74)	58.1% (74)
Saskatchewan	86.6% [†] (26)	80.5% [†] (26)
Manitoba	84.3% [†] (23)	81.7% [†] (23)
Ontario	75.5% (92)	73.6% (92)
Quebec	48.8% [†] (28)	30.5% [†] (28)
New Brunswick	59.1% [†] (26)	54.5% [†] (26)
Nova Scotia	68.0% [†] (24)	69.8% [†] (24)
Prince Edward Island	100% [†] (2)	100% [†] (2)
Nfld & Labrador	76.8% [†] (15)	76.6% [†] (15)

* Self-reported among consumers who reported purchasing cannabis tinctures in the past 12-months. Unweighted n's reported.

[†]Based on <30 respondents (unweighted) in the denominator; Interpret with caution.

**TABLE 3I. PERCENTAGE OF CANNABIS TOPICALS IN THE LAST YEAR
OBTAINED FROM A LEGAL SOURCE – 2020 (n=463)***

Percentage of cannabis topicals from legal sources		
	Unadjusted for frequency of use % (n)	Adjusted for frequency of use % (n)
Canada	73.5% (463)	66.5% (463)
British Columbia	70.1% (111)	54.7% (111)
Alberta	68.3% (91)	66.0% (91)
Saskatchewan	70.0% (34)	73.2% (34)
Manitoba	87.7% [†] (22)	78.5% [†] (22)
Ontario	75.4% (102)	70.1% (102)
Quebec	85.2% [†] (27)	78.8% [†] (27)
New Brunswick	50.0% [†] (28)	36.3% [†] (28)
Nova Scotia	76.0% [†] (26)	82.9% [†] (26)
Prince Edward Island	80.4% [†] (8)	46.8% [†] (8)
Nfld & Labrador	100% [†] (14)	100% [†] (14)

* Self-reported among consumers who reported purchasing cannabis topicals in the past 12-months. Unweighted n's reported.

[†]Based on <30 respondents (unweighted) in the denominator; Interpret with caution.

MODEL 1

ESTIMATING THE ASSOCIATION BETWEEN PROVINCE, SOCIODEMOGRAPHIC VARIABLES, AND PURCHASING CANANBIS FROM LEGAL SOURCES

Table 4 shows Outcome 1 –the percentage of dried flower purchased in the past 12 months from legal sources—in the 3-level categories used in the multinomial regression models: ‘none’ (0%), ‘some’ (>0% to <100%), and ‘all’ (100%).

TABLE 4. PERCENTAGE OF ‘NONE’ (0%), ‘SOME’ (<0% TO <100%), AND ‘ALL’ (100%) DRIED FLOWER PURCHASED IN THE LAST YEAR FROM A LEGAL SOURCE

	2019			2020		
	‘None’ (0%)	‘Some’ (>0% - <100%)	‘All’ (100%)	‘None’ (0%)	‘Some’ (>0% - <100%)	‘All’ (100%)
Canada	22.9% (620)	51.6% (1398)	25.5% (690)	12.7% (325)	50.9% (1300)	36.4% (931)
British Columbia	27.8% (103)	51.2% (190)	21.0% (78)	14.4% (55)	49.3% (187)	36.3% (138)
Alberta	10.4% (43)	63.7% (263)	25.9% (107)	12.8% (47)	51.3% (189)	36.0% (132)
Saskatchewan	24.6% (20)	47.7% (38)	27.7% (22)	5.6% (5)	60.6% (56)	33.8% (31)
Manitoba	20.0% (21)	59.7% (62)	20.3% (21)	18.1% (12)	45.1% (30)	36.8% (24)
Ontario	26.1% (291)	49.3% (550)	24.6% (275)	14.6% (150)	50.3% (517)	35.1% (361)
Quebec	26.5% (115)	45.1% (196)	28.4% (123)	10.2% (43)	50.4% (210)	39.4% (164)
New Brunswick	11.8% (8)	46.6% (33)	41.6% (29)	6.5% (5)	65.7% (47)	27.8% (20)
Nova Scotia	21.0% (17)	57.3% (47)	21.7% (18)	9.6% (8)	45.8% (37)	44.5% (35)
PEI	1.4%* (0)	24.7%* (1)	73.9%* (3)	9.3% (1)	35.9% (6)	54.8% (9)
Nfld & Labrador	3.9% (1)	53.0% (17)	43.0% (13)	0.2% (0)	58.2% (21)	41.6% (15)
Frequency of use						
< monthly consumer	28.4% (1)	18.5% (1)	53.1% (3)	18.1% (1)	14.9% (1)	67.0% (3)
Monthly consumer	21.3% (8)	32.8% (13)	45.8% (18)	14.8% (4)	31.0% (9)	54.2% (16)
Weekly consumer	22.1% (28)	44.5% (57)	33.4% (43)	14.8% (18)	39.1% (48)	46.1% (56)
Daily consumer	22.9% (582)	52.3% (1327)	24.7% (626)	12.6% (302)	51.8% (1242)	35.6% (855)
Sex						
Female	26.5% (286)	49.0% (529)	24.6% (266)	15.7% (172)	50.0% (549)	34.3% (377)
Male	20.5% (334)	53.4% (868)	26.1% (424)	10.5% (153)	51.5% (751)	38.0% (554)
Age						
21-35	16.7% (191)	56.3% (645)	26.9% (308)	8.4% (83)	55.2% (541)	36.3% (356)
36-45	22.2% (142)	50.5% (323)	27.3% (175)	12.7% (90)	52.6% (371)	34.7% (245)
46-55	31.4% (152)	45.1% (218)	23.6% (114)	19.5% (102)	42.7% (222)	37.8% (196)
56-65	30.7% (134)	48.2% (211)	21.1% (93)	14.6% (51)	47.2% (166)	38.2% (134)

	2019			2020		
	'None' (0%)	'Some' (>0% - <100%)	'All' (100%)	'None' (0%)	'Some' (>0% - <100%)	'All' (100%)
Ethnicity/Race						
Black	10.6% (7)	66.1% (44)	23.3% (15)	10.0% (6)	69.2% (39)	20.8% (12)
East/Southeast Asian	7.8% (5)	53.3% (32)	38.9% (23)	5.3% (4)	57.7% (40)	37.0% (26)
Indigenous	19.1% (22)	68.1% (77)	12.8% (15)	12.3% (9)	57.3% (40)	30.3% (21)
Latinx	17.5% (7)	37.5% (16)	45.0% (19)	38.5% (15)	26.1% (10)	35.4% (14)
Middle Eastern	N/A*	41.4%* (4)	58.6%* (5)	0.8%* (0)	66.8%* (17)	32.4%* (8)
South Asian	0.6% (0)	89.4% (35)	10.0% (4)	16.5% (12)	58.8% (42)	24.7% (18)
White	25.1% (556)	49.0% (1083)	25.9% (572)	13.0% (266)	49.3% (1010)	37.7% (771)
Other/Mixed	13.9% (23)	64.0% (107)	22.1% (37)	8.1% (14)	57.4% (101)	34.5% (61)
Education						
< high school	30.2% (118)	45.4% (177)	24.5% (95)	13.4% (38)	55.4% (158)	31.3% (89)
High school	20.3% (187)	52.0% (480)	27.6% (255)	10.2% (88)	55.1% (476)	34.7% (300)
Some college	23.6% (234)	52.7% (524)	23.7% (236)	14.4% (147)	46.8% (477)	38.8% (395)
Bachelor's degree	20.1% (81)	54% (217)	25.9% (104)	13.6% (53)	48.6% (189)	37.8% (147)
Income adequacy						
Very difficult/Difficult	24.5% (292)	54.6% (652)	20.9% (249)	12.7% (126)	55.1% (545)	32.2% (318)
Neither easy nor difficult	22.7% (191)	46.6% (392)	30.7% (258)	11.6% (103)	54.5% (483)	33.9% (301)
Easy/Very easy	20.0% (121)	54.2% (329)	25.9% (157)	14.7% (96)	38.5% (250)	46.8% (304)
Not reported	23.4% (15)	37.1% (24)	39.6% (25)	3.6% (1)	71.4% (21)	25.0% (7)
Rural vs. urban						
Urban	24% (496)	51.8% (1071)	24.3% (502)	13.7% (275)	50.6% (1016)	35.8% (719)
Rural	23.9% (64)	50.4% (134)	25.7% (68)	12.2% (33)	53.9% (144)	33.9% (90)
Missing	16.2% (60)	51.7% (192)	32.1% (120)	6.5% (18)	50.1% (140)	43.3% (121)

*Based on <30 respondents (unweighted) in the denominator; Interpret with caution.

The first model examined the association between province and legal purchases using a multinomial regression model ($F=17.19$, $p<.001$; $R^2=.20$, $AIC=10158.66$). Appendix A shows the model output. The likelihood of purchasing dried flower from legal sources in the past 12-months was significantly different across provinces ($F=6.55$, $p<.001$). As shown in Table 4, Ontario, BC and Quebec consumers were most likely to report purchasing 'no' dried flower from legal sources.

Survey year ($F=28.89$, $p<.001$), was strongly associated with purchasing dried flower from a legal source. Consumers were significantly more likely to purchase 'some' ($AOR=1.58$, $1.27-1.95$) and 'all' ($AOR=2.33$, $1.81-2.75$) of their dried flower from legal sources in 2020 compared to 2019. A two-way interaction between province and year was significant ($F=1.80$, $p=.026$), indicating greater increases between 2019 and 2020 in some provinces (e.g., Ontario), compared to other provinces (e.g., Alberta), as shown in Table 4.

Frequency of use was strongly associated with purchasing source ($F=35.76$, $p<.001$), with the most frequent consumers substantially less likely to report purchasing 'all' dried flower from legal

sources. For example, daily consumers had substantial lower odds of purchasing “all” of their dried flower from legal sources compared to less than monthly consumers (AOR=0.73, 0.56-0.94).

Age was also strongly associated with legal purchase ($F=11.06$, $p<.001$). Younger consumers were more likely to report legal dried flower purchases, with the highest levels reported among 21- to 35-year-olds, and the lowest levels among 56- to 65-year-olds. For example, compared 56–65-year-olds, 21–35-year-olds had more than three times the odds of purchasing ‘all’ their dried flower from legal sources (AOR=3.05, 2.27-4.09).

Differences were also observed by ethnicity/race ($F=3.56$, $p=.007$). Compared to Non-White consumers, White consumers were more likely to purchase ‘none’ than ‘some’ of their dried flower from legal sources (AOR = 1.53, 1.10-2.13) and more likely to purchase ‘all’ than ‘some’ from legal sources (AOR = 1.50, 1.17-1.91).

Education was also negatively associated with legal purchases ($F=4.12$, $p<.001$): consumers with less than high school were least likely to purchase dried flower legally, while consumers with a university education had more than twice the odds of purchasing ‘all’ their dried flower from legal sources (AOR=2.67, 1.73-4.11).

Income adequacy was also associated with legal purchases ($F=2.65$, $p=.014$): consumers with the lowest income adequacy were generally more likely to report purchasing ‘none’ of their dried flower from legal sources compared to other levels of income adequacy.

Modest differences were observed by urban versus rural status ($F=2.65$, $p=.032$): consumers with unknown rural/urban status were likely than urban consumers to report purchasing ‘some’ or ‘all’ dried flower from legal sources (AOR= 1.50, 1.05-2.15; AOR= 1.76, 1.24-2.50, respectively).

Finally, modest differences were also observed by sex ($F=3.14$, $p=.043$): females were somewhat less likely to purchase ‘some’ or ‘all’ of their dried flower from legal sources compared to males (AOR= 0.76, 0.61-0.94; AOR=0.86, 0.70-1.06, respectively).

SENSITIVITY ANALYSES – OUTCOMES 2 AND 3

The same pattern of findings was observed for the other two primary outcomes. For the multinomial model examining the percentage of all cannabis products purchased in the last 12-months (Outcome 2; $F=17.67$ ($p<.001$); AIC=12564.23, $R^2=.16$), the main effect of province was significant ($F=4.49$, $p<.001$), with a similar pattern of contrasts between specific provinces as in Outcome 1 (see Table 2 and Appendix A). As with Outcome 1, there was a two-way interaction between year and province ($F=1.99$, $p=.011$).

For the binary logistic regression model examining legality of ‘last purchase’ of dried flower (Outcome 3; $F=13.64$, $p<.001$; AIC= 6762.92, $R^2=.10$), the main effect of province was significant ($F=11.31$, $p<.001$), with a similar pattern of contrasts between specific provinces as Outcomes 1

and 2, shown in Table 2 and Appendix A. There was a trend towards a two-way interaction between year and province ($F=1.76$, $p=.080$). See Appendix A for detailed contrasts.

MODEL 2

ESTIMATING THE ASSOCIATION BETWEEN DRIED FLOWER PRICES AND PURCHASING FROM LEGAL SOURCES

Table 5 shows estimates for the average price of a gram of dried flower for each Canadian province. Data from the ICPS Cannabis Retail Scan are shown for the 10th percentile (the variable used in the multinomial model), as well as the mean and median prices from the same data set. Table 5 also shows price estimates for 2019 from two different sources for the purposes of comparison.

TABLE 5. PRICE OF DRIED FLOWER BY PROVINCE, DATA SOURCE, AND YEAR*

	ICPS Cannabis Retail Scan						Leafly	Aurora
	10 th percentile (\$/gram)		Mean (\$/gram)		Median (\$/gram)		Mean (\$/gram)	Mean (\$/gram)
	2019	2020	2019	2020	2019	2020	2019	2019
British Columbia	\$7.75	\$7.59	\$10.39	\$10.46	\$10.04	\$10.00	\$9.48	\$9.93
Alberta	\$9.48	\$8.28	\$11.99	\$11.50	\$11.49	\$11.13	\$12.05	\$11.56
Saskatchewan	\$9.30	\$8.00	\$12.17	\$11.04	\$11.77	\$10.86	\$12.95	\$10.99
Manitoba	\$10.05	\$8.57	\$12.95	\$11.74	\$12.63	\$11.50	\$12.30	\$13.15
Ontario	\$8.95	\$7.97	\$11.49	\$10.74	\$11.17	\$10.37	\$11.47	\$9.86
Quebec	\$6.90	\$5.41	\$9.03	\$8.67	\$8.75	\$8.36	\$8.43	\$7.69
New Brunswick	\$9.03	\$7.65	\$11.98	\$11.38	\$12.05	\$11.50	\$11.91	\$9.71
Nova Scotia	\$9.84	\$8.50	\$11.91	\$10.93	\$12.01	\$10.79	\$11.67	\$9.79
PEI	\$7.86	\$7.39	\$9.70	\$9.26	\$9.40	\$8.85	\$9.45	\$10.43
Nfld & Labrador	\$6.89	\$6.85	\$9.80	\$9.39	\$9.74	\$9.31	\$8.88	\$12.12

*2019 prices are adjusted for inflation for comparison with 2020 prices.

A multinomial model examining ‘no’, ‘some’, and ‘all’ dried flower from legal sources in the past 12-months was run with the 10th percentile price variable for each province ($F=20.39$, $p<.001$; $R^2=.18$, $AIC= 10241.39$). Appendix B shows the model output.

The main effect of price was not significant ($F=0.69$, $p=.503$). However, a two-way interaction between price and year was significant ($F=6.46$, $p=.002$), indicating a greater effect of prices in 2019 versus 2020. When the models were stratified by year, price had no significant effect in 2019 ($F=1.82$, $p=.163$), whereas price had a negative effect in 2020 ($F=5.15$, $p=.006$), such that higher prices were associated with lower odds of purchasing ‘some’ ($AOR=0.77$, $0.65-0.92$) and ‘all’ ($AOR=0.78$, $0.66-0.91$) dried flower from legal sources in 2020.

As expected, the pattern of findings for the other covariates included Model 2 were highly consistent with Model 1, which included province rather than price in the model, but was otherwise the same. As with Model 1, survey year ($F=20.41$, $p<.001$) and frequency of use ($F=36.12$, $p<.001$) were the strongest predictors of legal dried flower purchases. Similar effect sizes as Model 1 were also observed for age ($F=12.06$, $p<.001$), ethnicity/race ($F=3.54$, $p=.007$), education was also negatively associated with legal purchases ($F=3.49$, $p=.002$), income adequacy ($F=2.37$, $p=.028$), urban versus rural status ($F=3.23$, $p=.012$), and sex ($F=3.56$, $p=.029$). See Appendix B for details on specific contrasts.

SENSITIVITY ANALYSES – OUTCOMES 2 AND 3

The same pattern of findings was observed for the other two primary outcomes. For the multinomial model examining percentage of all cannabis products purchased in the last 12-months (Outcome 2; $F=21.89$, $p<.001$; $AIC=12608.38$, $R^2=.15$), the main effect of price was not significant ($F=.09$, $p=.912$), although there was a trend towards a two-way interaction between year and price ($F=2.55$, $p=.078$).

For the binary logistic regression model examining legality of last purchase of dried flower (Outcome 3; $F=12.61$, $p<.001$; $AIC=6876.18$, $R^2=.07$), the main effect of price was not significant ($F=0.11$, $p=.749$), although a two-way interaction between year and price was significant ($F=7.70$, $p=.006$), in which the effect of price and legal source at last purchased was more pronounced in 2020 ($\beta = -0.11$, $p=.048$) compared to 2019 ($\beta = .09$, $p=.051$). See Appendix B for detailed contrasts.

MODEL 3

ESTIMATING THE ASSOCIATION BETWEEN RETAIL STORES PER CAPITA, PROXIMITY TO LEGAL STORES, AND PURCHASING FROM LEGAL SOURCES

Model 3a—Retail stores per capita

The number of legal retail stores per capita was calculated in September 2019 and 2020 by province, as shown in Table 6.

**TABLE 6. NUMBER OF LEGAL ‘BRICK AND MORTAR’ RETAIL STORES
OVERALL AND PER CAPITA, BY PROVINCE AND YEAR**

	September 2019		September 2020	
	Number of stores	Stores per 100,000 residents*	Number of stores	Stores per 100,000 residents
British Columbia	67	1.32	294	5.71
Alberta	279	6.40	527	11.92
Saskatchewan	35	2.99	47	3.99
Manitoba	23	1.68	37	2.68
Ontario	24	0.17	112	0.76
Quebec	19	0.22	46	0.54
New Brunswick	20	2.57	20	2.56
Nova Scotia	12	1.24	16	1.63
PEI	4	2.54	4	2.51
Nfld & Labrador	25	4.78	26	4.98

*Population estimates sourced from Statistics Canada.⁴³

A multinomial model examining ‘no’, ‘some’, and ‘all’ dried flower from legal sources in the past 12-months was run with the provincial ‘retail stores per capita’ variable ($F=20.87$, $p<.001$; $R^2=.18$, $AIC=10220.23$). Appendix C shows the model output.

The main effect of retail stores per capita was significant ($F=7.60$, $p<.001$). Each one-unit increase in retail stores per 100,000 residents was associated with an increased odds of purchasing ‘all’ dried flower from a legal source in the past 12-months ($AOR=1.06$, $1.03-1.10$). A two-way interaction between price and year was significant ($F=12.70$, $p<.001$), indicating a greater effect of retail stores per capita in 2019 versus 2020. When models were stratified by year, in 2019 stores per capita had a significant positive effect ($F=19.28$, $p<.001$): higher per capita stores was associated with increased odds of purchasing ‘some’ ($AOR=1.14$, $1.07-1.22$) and ‘all’ ($AOR=1.21$, $1.14-1.29$) dried flower from legal sources. In 2020, stores per capita was not significantly associated with purchasing dried flower from legal sources in the past 12 months ($F=2.37$, $p<.094$).

As expected, the pattern of findings for the other covariates included in Model 3 were highly consistent with Models 1 and 2. As before, survey year ($F=20.97$, $p<.001$) and frequency of use ($F=36.46$, $p<.001$) were the strongest predictors of legal dried flower purchases. Similar effect sizes were also observed for age ($F=12.29$, $p<.001$), education ($F=3.62$, $p=.002$), ethnicity/race ($F=3.62$, $p=.006$), income adequacy ($F=2.58$, $p=.017$), urban versus rural status ($F=3.20$, $p=.013$), and sex ($F=3.56$, $p=.029$). See Appendix C for details on specific contrasts.

SENSITIVITY ANALYSES – OUTCOMES 2 AND 3

The same pattern of findings was observed for the other two primary outcomes. For the multinomial model examining the percentage of all cannabis products purchased in the last 12-months (Outcome 2; $F=22.44$, $p<.001$; $R^2=.15$, $AIC= 12584.27$). The main effect of retail stores per capita was significant ($F=8.19$, $p<.001$). Each one-unit increase in retail stores per 100,000 residents was associated with an increased odds of purchasing 'all' cannabis from a legal source in the past 12-months ($AOR=1.06$, $1.02-1.09$). A two-way interaction between price and year was also significant ($F=11.25$, $p<.001$), indicating a greater effect of retail stores per capita on the percentage of all cannabis purchased from legal sources in 2019 versus 2020, consistent with the results of models when stratified by year (2019 $F=16.69$, $p<.001$; 2020 $F=3.35$, $p=.035$).

For the binary logistic regression model examining legality of last purchase of dried flower (Outcome 3; $F=15.94$, $p<.001$; $AIC=6830.82$, $R^2=.08$), the main effect of retail store per capita was significant ($F=29.82$, $p<.001$). In addition, there was a two-way interaction between year and price ($F=18.53$, $p<.001$), indicating a greater effect of retail stores per capita in 2019 ($AOR=1.17$, $1.12-1.23$) than in 2020 ($AOR=1.04$, $1.01-1.06$).

Model 3b—Distance from a legal retail store

The distance that each consumer lived from a legal retail store at the time of the survey was calculated, as shown in Table 7.

TABLE 7. EUCLIDEAN DISTANCE BETWEEN POSTAL CODE OF RESPONDENTS' RESIDENCE AND POSTAL CODE OF NEAREST LEGAL RETAIL STORE (KM) BY PROVINCE AND YEAR

	2019 (n=2,707)				2020 (n=2,556)			
	< 3 km % (n)	3-4.9 km % (n)	5-9.9 km % (n)	≥ 10 km % (n)	< 3 km % (n)	3-4.9 km % (n)	5-9.9 km % (n)	≥ 10 km % (n)
Canada	31.0% (736)	10.9% (258)	16.2% (383)	41.9% (993)	49.5% (1139)	14.3% (329)	14.6% (336)	21.5% (494)
British Columbia	32.3% (103)	11.9% (38)	16.8% (53)	39.0% (124)	63.6% (211)	9.7% (32)	12.3% (41)	14.4% (48)
Alberta	73.3% (230)	8.0% (25)	9.7% (30)	9.0% (28)	88.2% (276)	5.3% (16)	1.5% (5)	5.0% (16)
Saskatchewan	63.8% (47)	12.0% (9)	6.1% (5)	18.0% (13)	64.2% (49)	13.4% (10)	5.6% (4)	16.8% (13)
Manitoba	50.2% (48)	13.0% (12)	13.9% (13)	22.8% (22)	70.1% (47)	13.6% (9)	3.9% (3)	12.5% (8)
Ontario	14.3% (140)	8.9% (87)	16.7% (163)	60.1% (589)	35.9% (325)	16.7% (151)	16.0% (145)	31.3% (283)
Quebec	24.0% (98)	14.5% (59)	22.5% (92)	39.0% (160)	34.8% (150)	19.3% (83)	26.9% (116)	19.0% (82)
New Brunswick	38.3% (20)	14.3% (7)	29.0% (15)	18.4% (9)	43.0% (24)	15.3% (9)	16.4% (9)	25.2% (14)
Nova Scotia	26.3% (19)	14.2% (10)	13.7% (10)	45.8% (34)	46.3% (34)	16.1% (12)	13.7% (10)	24.0% (18)
PEI	17.8%* (2)	38.3%* (5)	-* (0)	43.9%* (5)	12.1%* (1)	23.9%* (2)	25.4%* (2)	38.6%* (4)
Nfld & Labrador	66.9% (28)	9.6% (4)	4.0% (2)	19.5% (8)	60.2% (21)	10.0% (4)	3.3% (1)	26.6% (9)

*Based on <30 respondents (unweighted) in the denominator; Interpret with caution.

A multinomial model examining 'no', 'some', and all dried flower from legal sources in the past 12-months was run with the distance from legal retail store variable ($F=15.84$, $p<.001$; $R^2=.21$, $AIC=9024.63$). Appendix D shows the model output.

The main effect of distance to a legal store was significant ($F=2.32$, $p=.031$). Compared to consumer who lived 10 km or more from a legal store, consumers living within 3 km of a legal store were more likely to purchase 'some' and 'all' dried flower from a legal source in the past 12-months ($AOR=1.49$, $1.13-1.98$; $AOR=1.37$, $1.03-1.82$, respectively). Few differences were observed between consumers living more than 3km from a legal retail store. A two-way interaction between price and year was not significant ($F=0.37$, $p=.900$).

The pattern of findings for the covariates included in Model 3b were highly consistent with Models 1 through 3a. Survey year ($F=20.17$, $p<.001$) and frequency of use ($F=33.76$, $p<.001$) were the strongest predictors of legal dried flower purchases, followed by age ($F=10.36$, $p<.001$), education ($F=3.86$, $p<.001$), income adequacy ($F=2.77$, $p=.011$), ethnicity/race ($F=3.04$, $p=.016$), urban versus rural status ($F=3.20$, $p=.013$), and sex ($F=3.04$, $p=.048$). In addition, province was significant ($F=5.39$, $p<.001$) even after adjusting for individual-level distance from a retail store, with contrasts between provinces shown in Appendix D.

SENSITIVITY ANALYSES – OUTCOMES 2 AND 3

A multinomial model examined the percentage of all cannabis products purchased in the last 12-months (Outcome 2; ($F=16.06$, $p<.001$; $R^2=.17$, $AIC=11014.95$). Although the overall main effect of distance to a legal store was not significant ($F=1.24$, $p=.285$), the pairwise contrasts for consumers living within 3km of a store were similar to the contrasts observed for Outcome 1. No two-way interaction between distance to legal store and year was observed ($F=0.69$, $p=.657$).

The findings for the binary logistic regression model examining legality of last purchase of dried flower (Outcome 3) were similar to Outcome 2, ($F=12.77$, $p<.001$; $AIC=5823.42$, $R^2=.12$). The main effect of distance to a legal store was not significant ($F=2.05$, $p=.105$); however, the specific contrast of those living less than 3km versus 10km or more was significant ($AOR=1.26$, $1.00-1.57$). In addition, there was no two-way interaction between year and price was ($F=.45$, $p=.720$).

MODEL 4

ESTIMATING THE ASSOCIATION BETWEEN CONSUMER PERCEPTIONS OF PRICE, CONVENIENCE, QUALITY & SAFETY AND PURCHASING FROM LEGAL SOURCES

Table 8 shows perceptions among consumers of cannabis from legal versus illegal sources.

TABLE 8. PERCEPTIONS OF CANNABIS PURCHASED FROM LEGAL VERSUS ILLEGAL RETAIL SOURCES AMONG PAST 12-MONTH CANNABIS CONSUMERS BY YEAR

	Past 12-month dried flower consumers included in model	
	2019 n=2593 % (n)	2020 n=2549 % (n)
Convenience of buying legal marijuana		
Less convenient to buy	24.6% (637)	22.8% (582)
No Difference	28.5% (738)	29.9% (761)
More convenient to buy	28.0% (726)	29.5% (752)
Don't know	19.0% (492)	17.8% (453)
Quality of legal marijuana		
Lower quality	68.0% (1764)	60.6% (1545)
No Difference	12.6% (328)	16.6% (424)
Higher quality	6.3% (164)	8.5% (217)
Don't know	13.0% (337)	14.2% (363)
Price of legal marijuana		
More expensive	25.8% (670)	17.6% (448)
No difference	28.0% (727)	27.9% (710)
Less expensive	35.1% (910)	43.9% (1119)
Don't know	11.0% (286)	10.7% (272)
Safety of using legal marijuana		
Less safe to use	4.1% (105)	3.8% (96)
No Difference	42.5% (1103)	41.5% (1058)
Safer to use	40.5% (1051)	43.0% (1097)
Don't know	12.9% (333)	11.7% (298)
Safety of buying legal marijuana		
Less safe to buy	3.5% (90)	2.5% (63)
No Difference	35.9% (932)	36.2% (924)
Safer to buy	49.9% (1293)	50.8% (1295)
Don't know	10.7% (277)	10.5% (267)

A multinomial model examining 'no', 'some', and all dried flower from legal sources in the past 12-months was run with the five consumer perception variables ($F=25.03$, $p<.001$; $R^2=.40$, $AIC=8979.88$). Appendix E shows the model output.

The main effects of all five consumer perception variables were significant. The perceived convenience of buying legal cannabis was the strongest predictor of legal purchase ($F=30.20$, $p<.001$). Consumers who perceived cannabis from legal stores as 'less convenient' were less likely to purchase 'all' of their dried flower in the past 12-months from a legal source compared to those who perceived the convenience of cannabis from legal stores to be 'no different' ($AOR= 0.27$, $0.19-0.38$) or 'more convenient' ($AOR= 0.10$, $0.07-0.14$).

The perceived quality of legal cannabis was also strongly associated legality of dried flower source ($F=16.89$ $p<.001$). For example, consumers who perceived cannabis from legal stores as 'lower quality' were significantly less likely to purchase 'all' of their dried flower in the past 12-months from a legal source compared to those who perceived cannabis from legal stores to be 'no different' ($AOR=0.38$, $0.26-0.54$) or 'higher quality' ($AOR= 0.35$, $0.24-0.52$).

Perceptions of the relative price of cannabis was also associated with the legality of dried flower source ($F=7.19$, $p<.001$). Consumers who perceived cannabis from legal stores to be 'more expensive' were less likely to purchase 'all' of their dried flower in the past 12-months from a legal source compared to those who perceived the price of cannabis from legal stores to be 'no different' ($AOR= 0.43$, $0.29-0.64$) or 'less expensive' ($AOR= 0.50$, $0.27-0.92$).

The perception that legal cannabis was safe to use was significantly associated legality of dried flower source ($F=2.74$, $p<.012$). Consumers who perceived cannabis from legal stores as 'safer to use' were less likely to purchase 'all' ($AOR= 1.76$, $1.24-2.49$) of their dried flower in the past 12-months from a legal source compared to those who perceived the safety of cannabis from legal stores to be 'no different'.

Finally, the perception that legal cannabis was less safe to purchase was associated legality of dried flower source ($F=2.22$, $p=.039$). Consumers who perceived cannabis from legal stores was 'safer to buy' more likely to purchase 'all' of their dried flower in the past 12-months from a legal source compared to those who perceived the safety of cannabis from legal stores to be 'no different' ($AOR= 1.80$, $1.28-2.53$).

The pattern of findings for the other covariates included in main effects Model 4 were highly consistent with Models 1 through 3. Survey year ($F=15.58$, $p<.001$) and frequency of use ($F=20.93$, $p<.001$) were the strongest predictors of legal dried flower purchases, followed by age ($F=9.75$, $p<.001$), education ($F=3.79$, $p<.001$), ethnicity/race ($F=4.18$, $p=.0102$), urban versus rural status ($F=2.28$, $p=.059$), income adequacy ($F=1.90$, $p=.077$), and sex ($F=1.40$, $p=.246$). Province was also significant ($F=4.21$, $p<.001$), with contrasts between provinces shown in Appendix E.

SENSITIVITY ANALYSES – OUTCOMES 2 AND 3

A multinomial model examined the percentage of all cannabis purchased from legal sources in the past 12-months (Outcome 2; $F=29.96$, $p<.001$; $R^2=.37$, $AIC= 10989.65$). Four of the five consumer perception variables were significant—perception of convenience ($F=33.62$, $p<.001$), quality ($F=22.46$ $p<.001$), price ($F=16.71$, $p<.001$), and safety of using ($F=3.97$ $p<.001$)—with a trend towards significance for perceived safety of buying ($F=1.86$, $p=.08$).

The findings for the binary logistic regression model examining legality of last purchase of dried flower (Outcome 3) were similar to Outcome 2, ($F=29.27$, $p<.001$; $AIC=5839.05$, $R^2=.31$). All five perception variables were significantly associated with legality of last purchase: perception of convenience ($F=51.38$, $p<.001$), quality ($F=8.33$ $p<.001$), price ($F=7.20$, $p<.001$), safety of using ($F=7.09$ $p<.001$), and perceived safety of purchasing ($F=7.13$, $p<.001$). Detailed model output and contrasts are shown in Appendix E.

REASONS FOR PURCHASING ILLEGAL CANNABIS

Table 9 shows the reasons reported by consumers for purchasing cannabis from illegal or unauthorized sources. (Unlike the consumer perception data shown in Table 8, these questions were only asked of consumers who reported purchasing at least some cannabis from illegal sources). As Table 9 indicates, the order of reasons endorsed was similar across years; however, each of the 13 reasons asked in both 2019 and 2020 were endorsed by fewer respondents in 2020.

TABLE 9. REASONS FOR PURCHASING CANNABIS ILLEGALLY, AMONG CONSUMERS WHO OBTAINED <100% OF THEIR CANNABIS FROM LEGAL SOURCES IN THE PAST 12 MONTHS*

Reason for purchasing cannabis from illegal/unauthorized source	2019 n=2745 % (n)	2020 n=2766 % (n)	Difference (%)
Legal sources had higher prices	44.4% (1217)	35.5% (981)	-8.9%
Legal sources were less convenient	24.7% (679)	17.0% (470)	-7.7%
Legal stores too far away/the none where I live	21.9% (602)	10.9% (303)	-11.0%
Legal sources had lower-quality marijuana	20.8% (570)	16.7% (461)	-4.1%
Loyalty to my dealer	18.4% (504)	13.5% (374)	-4.9%
I wanted to stay anonymous	16.3% (448)	14.2% (391)	-2.1%
Legal sources had low supply or ran out	16.1% (443)	9.9% (275)	-6.2%
Legal sources didn't sell the products I wanted	16.0% (438)	14.3% (397)	-1.7%
I don't have a prescription for medical marijuana	14.0% (383)	11.0% (304)	-3.0%
Legal delivery is too slow	13.7% (375)	9.6% (264)	-4.1%
Legal online sources require a credit card	10.3% (282)	6.3% (174)	-4.0%
Legal sources require ID	7.5% (206)	5.8% (162)	-1.7%
I can't legally buy marijuana where I live	4.2% (115)	2.5% (70)	-1.7%
COVID-19 made it harder to buy from legal sources	(Not asked)	10.7% (296)	-

*Respondents could select 'all that apply' from a pre-coded checklist. 'Other' responses not shown.

DISCUSSION

ESTIMATES OF LEGAL PURCHASES OF CANNABIS IN CANADA

The findings indicate a substantial shift towards legal cannabis sources between 12- and 24-months after legalization of non-medical cannabis in Canada. Data from the ICPS surveys indicate that the total percentage of all dried flower that was purchased from legal retail sources in the past 12-months rose from 46% in 2019 to 60% in 2020. Similar increases were observed in the percentage of consumers who reported their ‘last purchase’ of dried flower was from a legal source: 37% in 2019 to 52% in 2020.

ICPS estimates of legal cannabis sales are consistent with other market-based indicators over the same time period. According to national retail sales reported by Statistics Canada, sales of medical and non-medical dried flower increased from \$5,695,303 in October 2019 to \$6,990,368 in October 2020—a relative increase of 30%.⁴⁴ By comparison, over the same period, ICPS estimates indicate a relative increase of 30% in the overall percentage of dried flower purchased from a legal sources, and a relatively increase of approximately 40% in the percentage of consumers whose ‘last purchase’ was from a legal source.

Provincial estimates of retail sales provide another point of comparison. The Ontario Cannabis Store estimated the legal share of cannabis sales in the province increase from 19% in 2019-2020, to 44% in 2020-2021.^{41,45} In Quebec, the Société Québécoise du Cannabis (SQDC), estimated that legal sales accounted for 30% of the cannabis market 2020.⁴⁶

ICPS data are also consistent with estimates from two of Canada’s national monitoring surveys: the Canadian Cannabis Survey (CCS) and the National Cannabis Survey (NCS). In the NCS, the use of legal sources in the past 3-months increased from 53% in the third quarter of 2019 to 68% in the fourth quarter of 2020; conversely, the use of illegal sources decreased from 49% to 35% over the same time period.^{47,48} The CCS estimated that 43% of past 12-month cannabis consumers reported “usually obtaining” cannabis from legal sources in 2019 compared to 54% in 2020, a relative increase of 26%.^{49,50} Conversely, 19% of cannabis consumers reported they usually obtain their cannabis from illegal sources in 2019 compared to 9% in 2020. The differences between ICPS, NCS, and CCS estimates are likely due to differences in question wording (e.g., “usual sources” in the CCS versus “any use” in the NCS, and percentages and ‘last purchase’ measures in the ICPS), as well as the corresponding timeframe (e.g., “past three months” in the NCS survey versus past year in ICPS and CCS). Crowd-sourced estimates of legal purchases collected through Statistics Canada’s StatsCannabis hub for the October to December 2019 are considerably higher than ICPS, CCS, and NCS estimates for the same period. According to StatsCannabis, 59% of dried flower and some oil purchases were made legally in 2019.⁵¹ However, crowdsourced data provides less reliable estimates due to self-selection bias inherent in the sampling procedures. Overall, the ICPS estimates

of legal purchases are consistent with other national population-based surveys and trends in retail sales over the same period.

The increase in legal market share observed in Canada is also consistent with findings from the United States (US), in which the market share of legal purchase has increased with the time since legalization. Estimates from the ICPS surveys conducted in the US indicates substantially higher levels of legal purchases in US states with ‘older’ recreational markets.⁵² For example, in Washington State and Colorado, where recreational stores opened in 2014, consumers reported purchasing close to 90% of dried flower from legal retail sources. In contrast, 68% and 58% reported purchasing dried flower legally in Massachusetts and Michigan in 2020, where recreational stores opened in 2018 and 2019, respectively. Moreover, the proportion of consumers purchasing dried flower from legal sources at last purchase increased in Maine, Massachusetts, and Michigan between 2019 and 2020, which illustrates the shift towards legal sources after legalization. This likely reflects the time it takes to open brick-and-mortar stores and establish the legal retail market cannabis legalization.

‘INDIVIDUAL-LEVEL’ DIFFERENCES IN LEGAL SOURCES OF CANNABIS

Across all analytical models, frequency of use was the strongest predictor of whether consumers reported obtaining cannabis from legal sources. For example, monthly and less-than-monthly consumers reported obtaining two thirds of their dried flower from legal sources, compared to less than half among daily consumers. More frequent cannabis consumers are likely to have more established product preferences and pre-existing relationships with illegal ‘dealers’, which could act as barriers to purchasing from legal sources.⁵³ Frequent consumers are also likely to be more price sensitive due to greater purchase amounts. The federal limit of 30 grams for single purchases of dried flower could also have a greater impact on daily consumers compared to less frequent consumers: daily consumers use an average of almost 2 grams of cannabis per day, which would necessitate more frequent visits to legal stores to adhere to the purchase limit.³⁰

Despite these differences, legal purchases of cannabis increased between 2019 and 2020 regardless of frequency of use. For example, the percentage of dried flower purchased from legal sources by daily consumers increased from 45% in 2019 to 59% in 2020. Furthermore, there was little or no evidence of an interaction between survey year and frequency of cannabis use: although daily consumers started at a lower level, between 2019 and 2020 they transitioned to legal sources at a similar rate as weekly, monthly, and less-than-monthly consumers. This is particularly important because daily consumers account for the vast majority of cannabis consumption, due to more frequent use and higher amounts of use on days used.^{30,54} As a result, the overall success in displacing illegal and unauthorized sources will largely be determined by purchasing behaviour of daily cannabis consumers.

Beyond frequency of use, several sociodemographic factors were consistently associated with purchasing cannabis from legal sources. Younger consumers were more likely to report purchasing

from legal sources, with the highest levels reported among 21- to 35-year-olds, and the lowest levels among 56- to 65-year-olds. Younger adults are generally known to embrace newer consumer trends more rapidly, which may transfer to the opening of newly legal cannabis stores. Younger consumers may also have had less-established sources of illegal cannabis compared to older consumers with a longer history of cannabis use prior to legalization.

There was also evidence that marginalized groups are less likely to purchase cannabis from legal sources. For example, ‘non-White’ consumers were less likely to purchase dried flower and cannabis from legal sources. This may reflect historical inequities in criminal sanctions for cannabis use, in which non-White consumers were more likely to experience cannabis-related convictions than White consumers despite similar prevalence of use.^{55,56} As a result, Non-White consumers may be more reluctant to purchase cannabis from legal stores that require identification—including government-run stores—out of a desire for greater anonymity. In addition to race/ethnicity: consumers with lower education and income adequacy were less likely to report purchasing cannabis from legal sources. This may be due to greater price sensitivity and the lower cost of illegal versus legal cannabis, particularly in the first 12-months post-legalization.³ In contrast, differences by sex were modest: although females were less likely to report purchasing dried flower from legal sources in some models, these differences were small and inconsistent across models.

Although the likelihood of purchasing cannabis from legal sources differed across several sociodemographic factors, it is notable that increases in legal purchasing were observed across all sociodemographic factors and characteristics of cannabis consumers.

PROVINCIAL DIFFERENCES IN LEGAL PURCHASES OF CANNABIS

The transition from the illegal to the legal cannabis market varies across the provinces. The current estimates are generally consistent with NCS data from 2019, which suggest the lower levels of legal purchases in Ontario, Manitoba and British Columbia, with higher levels in Alberta and the Atlantic provinces.⁵⁷ A separate analysis that combined retail sales data with estimates of overall cannabis consumption, estimated that 24% of the cannabis market was captured by the legal non-medical sales in September 2019, with the highest market share reported in Prince Edward Island (70%), and the lowest reported in Ontario (13%).⁵⁸ Similarly, in an analysis of 2019 data by Statistics Canada, sales per capita was the highest in Prince Edward Island (\$97 per resident) and lowest in British Columbia (\$10 per resident).⁵⁹

CANNABIS PRICES AND LEGAL PURCHASE SOURCES

The effect of price on consumer demand for cannabis has been established in previous research.¹⁵ In the current analysis, despite differences in cannabis prices between provinces, provincial-level prices was only modestly associated with the likelihood of purchasing cannabis from legal sources. The data suggest little or no association between provincial-level prices and the legal purchases in 2019; however, higher prices were associated with lower levels of purchasing from a legal source in

2020. There are several possible interpretations of these findings. First, consumer price may be less important than other factors in the initial period following legalization, such as convenient access to legal stores. If consumers are unable to access legal stores, the price of cannabis products within those stores will have no impact on purchasing decisions. The current findings are consistent with the notion that price becomes more important as retail access increases and consumers become familiarized with the legal market. Second, it is possible that the provincial-level prices are poor proxies for the actual prices paid by individual consumers. As noted in the Limitation section, below, prices may vary within provinces across different regions and retail outlets. To the extent that this is the case, using a provincial-level average for price would underestimate the true effect of cannabis prices. Future studies should examine the influence of price over a longer period of time, particularly given that retail price of cannabis has markedly decreased subsequent to the current data. Future studies should also examine the role of price for cannabis products other than dried flower, for which very little evidence exists.

AVAILABILITY AND PROXIMITY TO LEGAL RETAIL STORES

The findings highlight substantial provincial differences in access to legal retail stores in the first 12-months following cannabis legalization. In September 2019, the number of legal retail stores per capita varied more than 30-fold between Alberta—the province with the highest number of stores per capita—and Ontario and Quebec, Canada’s most populous provinces and those with the lowest number of stores per capita. Differences in the number of retail stores across provinces translated into substantial differences in retail proximity to stores for individual consumers. For example, among ICPS respondents in September 2019, 73% of dried flower consumers in Alberta lived within 3 kilometres of a store compared to 14% in Ontario. The current findings are similar to other data sources, which also document the large discrepancy in retail outlets per capita across provinces in the first year of legalization.^{60,61}

Consumers living in provinces with a higher number of legal retail stores were more likely to purchase cannabis from a legal source. Models that incorporated individual-level distance to retail stores accounted for even greater variance in predicting legal purchase sources, with the strongest effects for those living within 3 kilometres from stores. Interestingly, the magnitude of these associations was greater in 2019 than 2020. Given that the number of legal retail stores has increased considerably subsequent to the current data collection, future analyses should examine whether there is a ‘saturation point’, beyond which additional the density of retail stores has little effect on legal purchasing patterns.

In theory, the importance of geographic proximity to brick-and-mortar stores could be moderated by the presence of online stores and delivery services, which have increasingly popular among Canadian consumers.^{40,62,63,64} Unlike most US states that have legalized non-medical cannabis, online sales are legally available in all Canadian provinces. The importance of physical versus online access may also depend on access to the internet, access to a credit card, and patience for

delivery.^{65,66} Retail proximity to brick-and mortar stores may also serve a more general purpose of promoting the overall availability and potential quality of legally sourced cannabis.

CONSUMER PERCEPTIONS OF CANNABIS FROM LEGAL VERSUS ILLEGAL SOURCES

Consumer perceptions of factors such as price and convenience can be conceptualized as key mediators through which factors such as retail price and retail availability exert their influence.¹¹

For example, regardless of the actual price differential between legal and illegal sources of cannabis, consumers' perception of the price differential is the factor that will determine their purchase decisions on the basis of cost. Similarly, increased retail availability can only influence purchase decisions if consumers are aware of the presence and proximity of legal retail stores. Previous analyses have indicated that consumer perceptions of retail proximity and actual proximity to 'brick and mortar' legal cannabis stores are correlated; however, self-reported or 'perceived' distance from stores is a stronger predictor of legal cannabis purchases than actual distance from a store.⁴⁰

Overall, the current findings indicate the consumers have mixed perceptions of legal versus illegal sources of cannabis. Perceptions of retail access and convenience were relatively positive, even in the early stages of legalization: in both 2019 and 2020, greater proportions of consumers reported that legal cannabis was 'more convenient' to buy than the proportions who reported legal cannabis was 'less convenient' to buy. Perceptions of the costs of cannabis were mixed: 26% of consumers reported that legal cannabis was more expensive in 2019, which decreased to 18% in 2020; in fact, greater proportion perceived cannabis from legal sources to be less expensive. Consumers reported positive perceptions of the 'safety' of legal cannabis: approximately half of consumers reported that legal cannabis was 'safer to buy' and 40% reported it was 'safer to use' than illegal cannabis. Fewer than 5% of consumers perceived illegal cannabis to be safer to buy or use. In contrast, consumer perceptions of quality were mostly negative, with approximately two thirds of consumers reporting that legal cannabis was 'lower quality', with only modest reductions from 2019 (68%) to 2020 (61%). Other studies suggest that product quality is an important factor in consumer demand, and anecdotal reports of 'low quality' cannabis shortly after legalization are reflected in the current data.⁶⁷ The importance of quality may be particularly salient among more frequent consumers who have established preferences and greater experience across a range of products.⁵³

Consumer perception of factors such as price and retail availability may lag changes in the actual retail environment, particularly during the early stages of cannabis legalization. Previous analyses of ICPS data in the US, found that price perceptions were generally more favourable in states with a longer time with retail sales: Colorado, Washington, and Oregon.⁶⁸ As time since retail sales increased, respondents were less likely to report that legal cannabis was more expensive than illegal cannabis, which reflects actual decreases in price seen in Colorado, Washington and Oregon since retail sales began, as well as greater exposure and familiarity with legal retail sources.

REASONS FOR PURCHASING CANNABIS FROM ILLEGAL SOURCES

The reasons for purchasing cannabis from illegal sources were generally consistent with the broader findings from this analysis: consumers who had bought illegal cannabis cited higher prices, lower convenience and a lack of legal stores for legal cannabis as the most common reasons. Consumers also cited lower quality of cannabis, loyalty to dealers, and a desire to stay anonymous as reasons for purchasing from illegal sources. The findings are consistent with NCS data, in which consumers identified quality, safety, price, and accessibility as among the most important factors they considered when selecting a purchase source.^{69,70}

Notably, the level of endorsement for all thirteen reasons decreased in 2020 compared to 2019. The largest decreases were observed for lower convenience, a lack of legal stores, higher prices, lower quality of legal cannabis. Finally, in 2020, approximately 10% of consumers who purchased cannabis from illegal sources cited the COVID19 pandemic as a reason. However, this data should be interpreted within the broader context of the COVID19 measures assessed in the 2020 ICPS survey which are not reported in the current analysis. In particular, cannabis consumers were directly whether they were more or less likely to purchase from legal source as a result of the pandemic. Of all past 12-month cannabis consumers, 28% reported that they were more likely to get cannabis from legal sources due to the pandemic versus 9% who reported they were more likely to get cannabis from illegal sources due to the pandemic.⁷¹ Therefore, although COVID19 may have increased illegal purchasing among some consumers, approximately three times as many consumers reported an increase in legal purchases due to the pandemic.

LIMITATIONS

SAMPLE

This study is subject to limitations common to survey research. Respondents were recruited using non-probability-based sampling; therefore, the findings may not provide nationally representative estimates. However, the data were weighted by age group, sex, region, education and smoking status, and trends in the prevalence of cannabis use between 2018 and 2020 are highly consistent with trends observed in the CCS and NCS surveys. A comprehensive comparison of the sociodemographic profile and cannabis use behaviours between the ICPS, CCS, and NCS samples is available in the ICPS Technical Reports.^{28,29}

In addition, the sample for the current analysis included respondents between the ages of 21 and 65. As noted in the Methods section, the minimum legal age in Quebec (21 years of age) was used as the minimum age criteria for all respondents in the analysis. The lack of respondents over the age of 65 also represents a limitation, despite the fact that Canadians over 65 years of age have the lowest level of cannabis consumption across age groups.⁵⁷

ESTIMATING LEGAL VERSUS ILLEGAL SOURCES OF CANNABIS

The challenges of accurately estimating the size of illegal cannabis markets are well established.^{7,72,73} The current study relied on self-reported measures from population-based surveys, which have the potential to over-estimate the actual proportion of purchases from legal sources. For example, ICPS and NCS surveys conducted shortly before legalization, indicate an unrealistically high proportion of consumers who report accessing cannabis from legal sources, which was greater than the number of consumers with medical authorization during this period.⁵⁷ Over-reporting of legal sources may be due to social desirability bias, a reluctance to admit unlawful behaviour, or genuine confusion over the types of retail sources that are legal.

In the ICPS surveys, questions about the legal sources of dried flower and ‘all cannabis’ products specifically refer to *purchasing* cannabis; however, questions asked of individual products other than dried flower (e.g., edibles and concentrates), refer to the source of products that were consumed, but not explicitly to products that were purchased. It is unclear to what extent respondents included products that were gifted or shared, as well as ‘home grow’ or other consumer-made products in these estimates, such as ‘homemade’ edibles.

To date, there is very little data on estimates of legal versus illegal sources of cannabis products other than dried flower. The current report provides descriptive statistics for a range of product categories; however, it was not possible to model provincial-level factors such as price and retail availability to due reduced sample sizes for individual products and a corresponding lack of statistical power. Future analyses should examine sources of cannabis concentrates and other products given the increasing popularity of these product types.³⁰

Despite limitations inherent in any estimates of illegal cannabis, the ICPS estimates of legal cannabis are highly consistent with trends in retail sales data, as well as other population-based surveys. ICPS self-reported data also has advantages in being able to generate estimates for individual types of cannabis products, as well as separate price estimates for produces purchased from legal and illegal sources. More generally, the ICPS measures benefit from the use of images to assist respondents in reporting consumption amounts, as well as questions verifying amounts and prices.

SELECTION AND INCLUSION OF COVARIATES IN REGRESSION MODELS

The current project examined a range of sociodemographic factors, as well as several market-based factors in modelling the likelihood of legal cannabis purchasing. Other variables not included in the analysis could also account for legal cannabis purchasing, such as suspicion of authorities and concerns over anonymity. Several of these factors reported as ‘reasons’ for purchasing cannabis from illegal sources (see Table 9); however, these variables were not included in the modelling as they were only asked of consumers who reported purchasing from illegal sources and, therefore, could not be used to predict whether or not consumers purchased from illegal sources.

Previous studies have examined potential differences between provinces based on private versus government-run retail systems, which was not examined in the current analysis. Although private versus government-run retail systems may have an impact over the long term, there was no clear pattern in retail availability given that Alberta initially had the highest retail stores per capita and Ontario had among the lowest or second lowest. More generally, these types of analyses are potentially problematic given the potential for other confounding factors at the provincial level: the four provinces that have implemented a fully public model account for less than a quarter of the national population and Quebec dominates this group, with the remaining three provinces all representing smaller markets. This introduces potential confounds based on other regulatory measures implemented in Quebec, which are distinct from other provinces, including restrictions on THC and potency, and other notable regulatory measures.

As noted elsewhere, estimates of cannabis prices are somewhat variable across different data sources. The current analysis used price data that was collected directly from both online and brick-and-mortar retail stores. Sensitivity analyses demonstrated that the findings were generally consistent with other prices estimates sourced directly from retail outlets. One limitation is that price data was not yet available for the September/October period in 2020; instead, data from March to May 2020 was used in the model. Therefore, the price data for 2020 did not reflect the considerable price decreases that occurred through the later part of 2020, which coincided more closely with the ICPS survey data collection in September/October 2020. This may have attenuated potential association between price and legal cannabis purchasing.

Finally, provincial-level measures of price and retail stores per capita do not reflect regional differences within each province, such as the lower number of stores per capita typical of rural versus urban areas. Similarly, prices can vary across different legal retail outlets and regions within a province, which would have the effect of attenuating association with the individual-level purchasing outcomes examined in the current study. Future studies should examine the effect of variations in cannabis prices and retail density within provinces, which will be facilitated by changes in these factors over time.

SELECTION AND INCLUSION OF COVARIATES IN REGRESSION MODELS

More generally, any comparisons between 2020 and earlier years should be interpreted within the context of the COVID19 pandemic. The pandemic likely had both direct and indirect effects on cannabis consumption as well as purchase sources, as noted above. Data from additional years will help to identify potential short-term trends associated with the pandemic versus longer-term trends associated with cannabis legalization and factors such as price and retail availability.

SUMMARY

The current analysis suggests that time since legalization may be the most important determinant of the transition to legal sources of cannabis in a regulated market. On every indicator examined, consumers were substantially more likely to report purchasing cannabis from legal sources in 2020 compared to 2019, including across virtually every sociodemographic category. These data reflect the fundamental reality of newly legalized marketplaces: establishing legal retail structures and opening stores requires considerable time. In US states such as Washington State, Oregon, and Colorado—among the first jurisdictions in the world to legalize non-medical cannabis—this process has required several years; indeed, legal retail systems in these states continue to evolve. The current data suggests that the Canadian market is following a similar timeline and made substantial progress in the transition to the legal market in the first 24-months after legalization.

The analysis also suggests that provinces have made differential progress in transitioning consumers to legal sources. Several market-level factors that fall under provincial jurisdiction were associated with likelihood of purchasing cannabis from legal sources, including price and retail accessibility. Convenience—which is primarily driven by access to legal retail stores—was the most important factor among consumer perceptions and reasons for purchasing cannabis from illegal sources. Perceptions of product quality, which is influenced by a range of factors, also emerged as an important predictor of legal purchases.

The analysis also suggest that the relative importance of these factors changes over time. Retail accessibility—analysed as the number of retail stores per capita in each province and individual distance from a legal store—was associated with legal purchasing in both years, but the effect was stronger in 2019, when disparities in retail accessibility were at their greatest. Provincial differences in price explained little or no variation in legal purchasing in 2019, but were more significant in 2020. The shifting importance of factors reflects the rapidly evolving marketplace as well as the novelty of legalization. This evolution is likely to continue for several years, with implications for how consumers source their cannabis in Canada.

Purchasing cannabis from legal sources also differed by individual-level sociodemographic factors. Daily consumers accounted for the vast majority of cannabis consumed in Canada and will be critical in Canada's overall success in displacing illegal and unauthorized sources of cannabis. Marginalized groups—including racial minorities and those with low education and income adequacy—also warrant particular attention to ensure equitable access to legal markets. Although the likelihood of purchasing cannabis from legal sources differed across these sociodemographic factors, it is notable that increases in legal purchasing were observed across virtually all population subgroups between 12- and 24-months after legalization.

Overall, the findings highlight that no one single factor accounts for the consumer decision to purchase from a legal versus illegal source, and the relative influence of factors shifts over time. Data for the current analysis were collected in 2020; however, the cannabis market in Canada has undergone further changes, including marked reductions in retail price and increases in the number of legal stores in many provinces. These changes are likely to have accelerated the transition to the legal market and warrant further examination.

Finally, the impact of the COVID19 pandemic should be considered when interpreting changes in the cannabis market between 2019 and 2020. There is emerging evidence that the pandemic has impacted consumption levels and sources of cannabis in Canada. In addition, the impact of COVID19 likely varied across individual consumers and by sociodemographic subgroup. Future analysis of the cannabis market will help to distinguish shorter-term pandemic effects from longer-term trends of cannabis legalization.

APPENDIX

Appendix A: Model 1 output (Province)

MODEL 1 – OUTCOME 1

MULTINOMIAL MODEL PREDICTING PERCENTAGE OF DRIED FLOWER CONSUMED IN THE PAST 12 MONTHS FROM LEGAL SOURCES (UNWEIGHTED N=5056)

F Likelihood ratio (p level): 17.19(p<.001)

Degrees of freedom: Numerator =56, Denominator=5000

Model max rescaled R2: 0.1976

AIC: 10158.668

	'SOME' LEGAL (VS.' NONE')		'ALL LEGAL' (VS. 'NONE')	
	Beta	P level	Beta	P level
Intercept	-1.7801	<.0001	-1.1682	<.0001
Year				
2019	Reference		Reference	
2020	0.4544	<.0001	0.8007	<.0001
Province				
British Columbia	-0.1766	0.2289	0.0136	0.9244
Alberta	0.4595	0.0042	0.8337	<.0001
Saskatchewan	0.5513	0.0377	0.7589	0.0023
Manitoba	0.2077	0.4156	0.3846	0.1082
Quebec	0.3698	0.018	0.5583	0.0002
New Brunswick and PEI	0.627	0.0041	0.8179	0.0001
Nova Scotia	0.794	0.0008	1.0885	<.0001
Nfld & Labrador	2.3072	<.0001	2.8889	<.0001
Ontario	Reference		Reference	
Frequency of use				
< monthly consumer	Reference		Reference	
Monthly consumer	0.8822	<.0001	-0.1655	0.2674
Weekly consumer	1.1533	<.0001	-0.1815	0.2333
Daily consumer	1.4445	<.0001	-0.3188	0.0162
Sex				
Female	-0.2718	0.0131	-0.1509	0.1585
Male	Reference		Reference	
Age				

21-35	0.9976	<.0001	1.1139	<.0001
36-45	0.6146	0.0001	0.7652	<.0001
46-55	0.305	0.0588	0.3543	0.0236
56-65	Reference		Reference	

Ethnicity/Race

Non-white	0.4257	0.0113	0.0209	0.8998
Other/Mixed	0.3552	0.1307	0.1121	0.6346
White	Reference		Reference	

Education

Bachelor's degree	0.7262	0.0009	0.9811	<.0001
High school diploma	0.5209	0.0143	0.6071	0.0053
Some college	0.4048	0.0383	0.5119	0.0103
Less than high school	Reference		Reference	

Income adequacy

Not reported	0.2572	0.6692	0.7472	0.2351
Neither easy nor difficult	-0.0236	0.8541	0.1723	0.1729
Easy/Very easy	-0.1839	0.1846	0.2443	0.0682
Very difficult/Difficult	Reference		Reference	

Rural vs. urban

Missing	0.4079	0.0262	0.5652	0.0017
Rural	0.1892	0.2797	0.1451	0.3977
Urban	Reference		Reference	

Device type

Smartphone	0.1981	0.0894	-0.0649	0.5664
Tablet	-0.0745	0.7509	0.1441	0.5092
Computer	Reference		Reference	

*Unweighted n's are shown.

MODEL 1 – OUTCOME 2

MULTINOMIAL MODEL PREDICTING PERCENTAGE OF ALL CANNABIS PRODUCTS CONSUMED IN THE PAST 12 MONTHS FROM LEGAL SOURCES (UNWEIGHTED N=6,629)*

F Likelihood ratio (p level): 17.67 (p<.001)

Degrees of freedom: Numerator=56, Denominator=6573

Model max rescaled R2: 0.1610

AIC: 12564.233

	'SOME' LEGAL (VS.' NONE')		'ALL' LEGAL (VS. 'NONE')	
	Beta	P level	Beta	P level
Intercept	-1.0291	0.0003	-0.4196	0.1139
Year				
2019	Reference		Reference	
2020	0.482	<.0001	0.8448	<.0001
Province				
British Columbia	-0.0479	0.7465	-0.0211	0.8854
Alberta	0.2938	0.0632	0.6288	<.0001
Saskatchewan	0.708	0.0081	0.9886	<.0001
Manitoba	0.0992	0.699	0.1948	0.4257
Quebec	0.0928	0.5463	0.2092	0.1621
New Brunswick and PEI	0.3632	0.1024	0.5232	0.0148
Nova Scotia	0.2796	0.1816	0.437	0.0328
Nfld & Labrador	2.0388	<.0001	2.5987	<.0001
Ontario	Reference		Reference	
Frequency of use				
< monthly consumer	Reference		Reference	
Monthly consumer	0.618	0.0001	-0.1655	0.2674
Weekly consumer	1.0756	<.0001	0.0134	0.934
Daily consumer	1.0207	<.0001	-0.5306	<.0001
Sex				
Female	0.0029	0.9787	0.2224	0.0373
Male	Reference		Reference	
Age				
21-35	0.8493	<.0001	0.7317	<.0001
36-45	0.3953	0.0119	0.3596	0.0159
46-55	0.3761	0.017	0.2317	0.1223
56-65	Reference		Reference	
Ethnicity/Race				
Non-white	0.5275	0.0015	0.2996	0.0703
Other/Mixed	0.3004	0.2078	0.0101	0.9669
White	Reference		Reference	
Education				
Bachelor's degree	0.6186	0.0048	0.9526	<.0001

High school diploma	0.3631	0.0945	0.5309	0.0167
Some college	0.2277	0.2537	0.4485	0.0285
Less than high school	Reference		Reference	
Income adequacy				
Not reported	-0.1913	0.6866	-0.168	0.71
Neither easy nor difficult	0.00747	0.9533	0.1951	0.1194
Easy/Very easy	-0.00011	0.9993	0.331	0.0141
Very difficult/Difficult	Reference		Reference	
Rural vs. urban				
Missing	0.6662	0.0004	0.6883	0.0002
Rural	0.0895	0.602	0.0456	0.7817
Urban	Reference		Reference	
Device type				
Smartphone	0.2935	0.0115	-0.00554	0.9611
Tablet	0.0902	0.6659	0.0645	0.7509
Computer	Reference		Reference	

MODEL 1 – OUTCOME 3

LOGISTIC REGRESSION MODEL PREDICTING LEGAL SOURCE OF 'LAST PURCHASE' OF DRIED FLOWER (UNWEIGHTED N=4,726)

F Likelihood ratio (p level): 13.64 (p<.001)

Degrees of freedom: Numerator=28, Denominator=4698

Model max rescaled R2: 0.1035

AIC: 6762.921

	Beta	Standard error	P level
Intercept	-1.5797	0.2708	<.0001
Year			
2019	Reference		
2020	0.4951	0.079	<.0001
Province			
British Columbia	0.0439	0.1139	0.6997
Alberta	0.8369	0.1209	<.0001
Saskatchewan	0.6799	0.1745	<.0001
Manitoba	0.0926	0.1642	0.5728
Quebec	0.3988	0.1173	0.0007
New Brunswick and PEI	0.7199	0.171	<.0001
Nova Scotia	0.6872	0.1588	<.0001
Nfld & Labrador	1.0759	0.2108	<.0001
Ontario	Reference		
Frequency of use			
< monthly consumer	0.6362	0.1114	<.0001
Monthly consumer	0.5961	0.1131	<.0001
Weekly consumer	0.5592	0.1074	<.0001
Daily consumer	Reference		
Sex			
Female	0.1063	0.0794	0.1806
Male	Reference		
Age			
21-35	0.2393	0.1235	0.0527
36-45	0.103	0.1275	0.4193
46-55	-0.0695	0.1341	0.6041
56-65	Reference		
Ethnicity/Race			
Other/Mixed	-0.0201	0.1826	0.9122
White	0.2205	0.1117	0.0484
Non-white	Reference		
Education			
Bachelor's degree	0.5663	0.1648	0.0006
High school diploma	0.294	0.1637	0.0725

Some college	0.4411	0.1508	0.0035
Less than high school	Reference		
Income adequacy			
Not reported	-0.1546	0.3764	0.6813
Neither easy nor difficult	0.3094	0.0952	0.0012
Easy/Very easy	0.2304	0.1026	0.0247
Very difficult/Difficult	Reference		
Rural vs. urban			
Missing	0.0123	0.1193	0.9179
Rural	0.2277	0.1393	0.1023
Urban	Reference		
Device type			
Smartphone	-0.0471	0.1798	0.7934
Computer	-0.0866	0.1789	0.6283
Tablet	Reference		

Appendix B: Model 2 output (Price)

MODEL 2 – OUTCOME 1

MULTINOMIAL MODEL PREDICTING PERCENTAGE OF DRIED FLOWER CONSUMED IN THE PAST 12 MONTHS FROM LEGAL SOURCES (UNWEIGHTED N=5056)

F Likelihood ratio (p level): 20.39 (p<.001)

Degrees of freedom: Numerator=42, Denominator=5014

Model max rescaled R2: 0.1776

AIC: 10241.390

	'SOME' LEGAL (VS. 'NONE')		'ALL LEGAL (VS. 'NONE')	
	Beta	P level	Beta	P level
Intercept	-0.8818	0.0768	0.276	0.5554
Year				
2019	Reference		Reference	
2020	0.4181	0.0006	0.7394	<.0001
Price				
Provincial price (10 th percentile)	-0.0298	0.5282	-0.0527	0.2423
Frequency of use				
< monthly consumer	Reference		Reference	
Monthly consumer	0.8537	<.0001	0.0557	0.7124
Weekly consumer	1.126	<.0001	-0.2188	0.1472
Daily consumer	1.4123	<.0001	-0.3634	0.0052
Sex				
Female	-0.2868	0.008	-0.1645	0.1182
Male	Reference		Reference	
Age				
21-35	1.0361	<.0001	1.1562	<.0001
36-45	0.6491	<.0001	0.8014	<.0001
46-55	0.3258	0.0413	0.3716	0.0156
56-65	Reference		Reference	
Ethnicity/Race				
Non-white	0.3612	0.0287	-0.0629	0.6986
Other/Mixed	0.2964	0.2043	0.0481	0.8369
White	Reference		Reference	
Education				
Bachelor's degree	0.6746	0.0018	0.8973	<.0001
High school diploma	0.4792	0.022	0.5527	0.0102
Some college	0.3833	0.046	0.4826	0.0148
Less than high school	Reference		Reference	
Income adequacy				
Not reported	0.2072	0.7286	0.6689	0.2733

Neither easy nor difficult	-0.0445	0.7252	0.1333	0.2826
Easy/Very easy	-0.2084	0.1289	0.1947	0.1392
Very difficult/Difficult	Reference		Reference	
Rural vs. urban				
Missing	Reference		Reference	
Rural	-0.1779	0.4486	-0.3605	0.1116
Urban	-0.4319	0.0178	-0.5979	0.0008
Device type				
Smartphone	0.2091	0.0707	-0.038	0.7342
Tablet	-0.0814	0.7265	0.1244	0.5623
Computer	Reference		Reference	

MODEL 2 – OUTCOME 2

MULTINOMIAL MODEL PREDICTING PERCENTAGE OF ALL CANNABIS PRODUCTS CONSUMED IN THE PAST 12 MONTHS FROM LEGAL SOURCES (UNWEIGHTED N=6629)

F Likelihood ratio (p level): 21.89 (p<.001)

Degrees of freedom: Numerator=42, Denominator=6587

Model max rescaled R2: 0.1504

AIC: 12608.376

	'SOME' LEGAL (VS. 'NONE')		'ALL LEGAL (VS. 'NONE')	
	Beta	P level	Beta	P level
Intercept	-0.3895	0.4374	0.3585	0.4634
Year				
2019	Reference		Reference	
2020	0.4986	<.0001	0.8615	<.0001
Price				
Provincial price (10 th percentile)	0.0178	0.7151	0.0201	0.6719
Frequency of use				
< monthly consumer	Reference		Reference	
Monthly consumer	0.6092	0.0002	-0.1875	0.2053
Weekly consumer	1.0628	<.0001	-0.013	0.9356
Daily consumer	1.0006	<.0001	-0.5663	<.0001
Sex				
Female	-0.0108	0.9205	0.2041	0.0528
Male	Reference		Reference	
Age				
21-35	0.8752	<.0001	0.7703	<.0001
36-45	0.4104	0.0087	0.3846	0.0092
46-55	0.3885	0.0131	0.2487	0.094
56-65	Reference		Reference	
Ethnicity/Race				
Non-white	0.4911	0.0029	0.2358	0.1502
Other/Mixed	0.2703	0.256	-0.0409	0.8655
White	Reference		Reference	
Education				
Bachelor's degree	0.5872	0.0065	0.89	<.0001
High school diploma	0.347	0.106	0.502	0.0221
Some college	0.2196	0.2641	0.4278	0.0341
Less than high school	Reference		Reference	
Income adequacy				
Not reported	-0.1936	0.6809	-0.1746	0.6975
Neither easy nor difficult	-0.00619	0.9611	0.1666	0.1795

Easy/Very easy	-0.0251	0.8551	0.2848	0.0329
Very difficult/Difficult	Reference		Reference	
Rural vs. urban				
Missing	Reference		Reference	
Rural	-0.5369	0.023	-0.5803	0.0123
Urban	-0.6706	0.0003	-0.6942	0.0002
Device type				
Smartphone	0.3006	0.0093	0.0122	0.9141
Tablet	0.0901	0.6645	0.0637	0.7505
Computer	Reference		Reference	

MODEL 2 – OUTCOME 3

LOGISTIC REGRESSION MODEL PREDICTING LEGAL SOURCE OF 'LAST PURCHASE' OF DRIED FLOWER (UWEIGHTED N=4,726)

F Likelihood ratio (p level): 12.61 (p<.001)

Degrees of freedom: Numerator=21, Denominator=4705

Model max rescaled R2: 0.0727

AIC: 6876.179

	Beta	Standard error	P level
Intercept	-1.2025	0.401	0.0027
Year			
2019	Reference		
2020	0.4801	0.0859	<.0001
Price			
Provincial price (10 th percentile)	-0.0121	0.0363	0.7388
Frequency of use			
< monthly consumer	0.6688	0.1105	<.0001
Monthly consumer	0.6017	0.1121	<.0001
Weekly consumer	0.5454	0.1053	<.0001
Daily consumer	Reference		
Sex			
Female	0.0885	0.078	0.2567
Male	Reference		
Age			
21-35	0.2688	0.1209	0.0263
36-45	0.1309	0.1261	0.2996
46-55	-0.0646	0.1316	0.6234
56-65	Reference		
Ethnicity/Race			
Other/Mixed	-0.00822	0.1819	0.964
White	0.2816	0.1106	0.0109
Non-white	Reference		
Education			
Bachelor's degree	0.471	0.1606	0.0034
High school diploma	0.2489	0.1612	0.1226
Some college	0.3968	0.1481	0.0074
Less than high school	Reference		
Income adequacy			
Not reported	-0.1983	0.3647	0.5867
Neither easy nor difficult	0.2627	0.0936	0.005
Easy/Very easy	0.1707	0.1011	0.0913

Very difficult/Difficult	Reference		
Rural vs. urban			
Missing	0.0231	0.1169	0.8436
Rural	0.2827	0.1353	0.0367
Urban	Reference		
Device type			
Smartphone	-0.0242	0.1759	0.8908
Computer	-0.0797	0.1753	0.6494
Tablet	Reference		

Appendix C: Model 3a output (Retail stores per capita)

MODEL 3A – OUTCOME 1

MULTINOMIAL MODEL PREDICTING PERCENTAGE OF DRIED FLOWER CONSUMED IN THE PAST 12 MONTHS FROM LEGAL SOURCES (UNWEIGHTED N=5,056)

F Likelihood ratio (p level): 20.87 (p<.001)

Degrees of freedom: Numerator=42, Denominator=5014

Model max rescaled R2: 0.1814

AIC: 10220.230

	'SOME' LEGAL (VS. 'NONE')		'ALL' LEGAL (VS. 'NONE')	
	Beta	P level	Beta	P level
Intercept	-1.1636	0.0003	-0.2615	0.3777
Year				
2019	Reference		Reference	
2020	0.4134	0.0002	0.6967	<.0001
Legal retail stores				
Provincial stores (per 100,000)	0.0245	0.1557	0.0595	0.0004
Frequency of use				
< monthly consumer	Reference		Reference	
Monthly consumer	0.8517	<.0001	0.0513	0.7348
Weekly consumer	1.1213	<.0001	-0.2199	0.1454
Daily consumer	1.4049	<.0001	-0.3771	0.0039
Sex				
Female	-0.2871	0.0079	-0.1688	0.1099
Male	Reference		Reference	
Age				
21-35	1.0371	<.0001	1.1586	<.0001
36-45	0.6582	<.0001	0.819	<.0001
46-55	0.3279	0.0399	0.3783	0.014
56-65	Reference		Reference	
Ethnicity/Race				
Non-white	0.354	0.0327	-0.0767	0.6385
Other/Mixed	0.2857	0.2216	0.0292	0.9007
White	Reference		Reference	
Education				
Bachelor's degree	0.6675	0.002	0.9003	<.0001
High school diploma	0.4761	0.023	0.5484	0.0107
Some college	0.3731	0.0527	0.4705	0.0174
Less than high school	Reference		Reference	
Income adequacy				

Not reported	0.2155	0.7177	0.6901	0.2582
Neither easy nor difficult	-0.0366	0.7725	0.1586	0.2015
Easy/Very easy	-0.1965	0.1525	0.2269	0.0854
Very difficult/Difficult	Reference		Reference	
Rural vs. urban				
Missing	Reference		Reference	
Rural	-0.1782	0.4485	-0.3639	0.1097
Urban	-0.4305	0.0182	-0.596	0.0008
Device type				
Smartphone	0.1961	0.0901	-0.0649	0.5617
Tablet	-0.0851	0.714	0.132	0.5389
Computer	Reference		Reference	

MODEL 3A – OUTCOME 2

MULTINOMIAL MODEL PREDICTING PERCENTAGE OF ALL CANNABIS PRODUCTS CONSUMED IN THE PAST 12 MONTHS FROM LEGAL SOURCES (UNWEIGHTED N=6,629)

F Likelihood ratio (p level): 22.44 (p<.001)

Degrees of freedom: Numerator=42, Denominator=6587

Model max rescaled R2: 0.1540

AIC: 12584.269

	'SOME' LEGAL (VS.' NONE')		'ALL' LEGAL (VS. 'NONE')	
	Beta	P level	Beta	P level
Intercept	-0.2688	0.3857	0.4333	0.1504
Year				
2019	Reference		Reference	
2020	0.4501	<.0001	0.7507	<.0001
Legal retail stores				
Provincial stores (per 100,000)	0.0194	0.2687	0.0544	0.0015
Frequency of use				
< monthly consumer	Reference		Reference	
Monthly consumer	0.612	0.0002	-0.1772	0.2329
Weekly consumer	1.0622	<.0001	-0.00415	0.9794
Daily consumer	1.0015	<.0001	-0.5617	<.0001
Sex				
Female	-0.0104	0.9232	0.1996	0.0591
Male	Reference		Reference	
Age				
21-35	0.8703	<.0001	0.7628	<.0001
36-45	0.4074	0.0094	0.3813	0.0102
46-55	0.3866	0.0137	0.2452	0.0997
56-65	Reference		Reference	
Ethnicity/Race				
Non-white	0.495	0.0027	0.2411	0.1417
Other/Mixed	0.2672	0.2623	-0.0438	0.8563
White	Reference		Reference	
Education				
Bachelor's degree	0.5959	0.0058	0.9159	<.0001
High school diploma	0.3527	0.0994	0.5129	0.0192
Some college	0.2201	0.2634	0.4302	0.0336
Less than high school	Reference		Reference	
Income adequacy				
Not reported	-0.1877	0.6905	-0.1722	0.702
Neither easy nor difficult	-0.0046	0.971	0.1823	0.141
Easy/Very easy	-0.0206	0.8809	0.3073	0.0215

Very difficult/Difficult	Reference		Reference	
Rural vs. urban				
Missing	Reference		Reference	
Rural	-0.5362	0.0232	-0.5855	0.0117
Urban	-0.6694	0.0003	-0.695	0.0002
Device type				
Smartphone	0.2995	0.0096	0.00264	0.9813
Tablet	0.09	0.665	0.069	0.7313
Computer	Reference		Reference	

MODEL 3A – OUTCOME 3

LOGISTIC REGRESSION MODEL PREDICTING LEGAL SOURCE OF 'LAST PURCHASE' OF DRIED FLOWER (N=4,726)

F Likelihood ratio (p level): 15.94 (p<.001)

Degrees of freedom: Numerator=19, Denominator=4707

Model max rescaled R2: 0.0828

AIC: 6830.816

	Beta	Standard error	P level
Intercept	-1.3846	0.2577	<.0001
Year			
2019	Reference		
2020	0.3762	0.0822	<.0001
Legal retail stores			
Provincial stores (per 100,000)	0.0666	0.0122	<.0001
Frequency of use			
< monthly consumer	0.687	0.1105	<.0001
Monthly consumer	0.6116	0.1118	<.0001
Weekly consumer	0.5694	0.1058	<.0001
Daily consumer	Reference		
Sex			
Female	0.0962	0.0783	0.2193
Male	Reference		
Age			
21-35	0.2618	0.1217	0.0315
36-45	0.1299	0.1269	0.3061
46-55	-0.0596	0.133	0.6543
56-65	Reference		
Ethnicity/Race			
Other/Mixed	-0.00706	0.1809	0.9689
White	0.3024	0.1098	0.0059
Non-white	Reference		
Education			
Bachelor's degree	0.4645	0.16	0.0037
High school diploma	0.2327	0.1612	0.1489
Some college	0.3821	0.1482	0.01
Less than high school	Reference		
Income adequacy			
Not reported	-0.1951	0.3542	0.5818
Neither easy nor difficult	0.2953	0.0941	0.0017
Easy/Very easy	0.2018	0.1015	0.0468
Very difficult/Difficult	Reference		

Device type			
Smartphone	-0.0593	0.1794	0.741
Computer	-0.1019	0.1786	0.5686
Tablet	Reference		

Appendix D: Model 3b output (Distance to legal store)

MODEL 3B – OUTCOME 1

MULTINOMIAL MODEL PREDICTING PERCENTAGE OF DRIED FLOWER CONSUMED IN THE PAST 12 MONTHS FROM LEGAL SOURCES (UNWEIGHTED N=4,489)

F Likelihood ratio (p level): 15.84 (p<.001)

Degrees of freedom: Numerator=58, Denominator=4431

Model max rescaled R2: 0.2105

AIC: 9024.632

	'SOME' LEGAL (VS.' NONE')		'ALL' LEGAL (VS. 'NONE')	
	Beta	P level	Beta	P level
Intercept	-1.8196	<.0001	-1.2403	<.0001
Year				
2019	Reference		Reference	
2020	0.3159	0.0083	0.6989	<.0001
Distance to legal retail store				
< 3km	0.3122	0.0317	0.4016	0.0053
3 to <5 km	-0.0165	0.9328	-0.0635	0.7408
5 to <10 km	0.0429	0.8077	-0.0942	0.5729
10 km or more	Reference		Reference	
Province				
British Columbia	-0.2315	0.1379	-0.0586	0.7059
Alberta	0.2527	0.1661	0.6019	0.0009
Saskatchewan	0.4357	0.1178	0.705	0.0066
Manitoba	0.1323	0.635	0.1529	0.5584
Quebec	0.3429	0.0423	0.5865	0.0003
New Brunswick and PEI	0.6587	0.0045	0.8411	0.0003
Nova Scotia	0.7964	0.0011	1.02	<.0001
Nfld & Labrador	2.0957	<.0001	2.6496	<.0001
Ontario	Reference		Reference	
Frequency of use				
< monthly consumer	Reference		Reference	
Monthly consumer	0.8609	<.0001	0.0725	0.6528
Weekly consumer	1.2196	<.0001	-0.1739	0.2805
Daily consumer	1.4881	<.0001	-0.3428	0.0153
Sex				
Female	-0.2776	0.0161	-0.134	0.2379
Male	Reference		Reference	
Age				
21-35	1.0064	<.0001	1.1266	<.0001
36-45	0.6338	0.0001	0.7622	<.0001
46-55	0.2866	0.0858	0.3209	0.0479
56-65	Reference		Reference	

Ethnicity/Race				
Non-white	0.3488	0.0478	-0.0572	0.7403
Other/Mixed	0.3403	0.1735	0.00183	0.9942
White	Reference		Reference	
Education				
Bachelor's degree	0.7526	0.0012	1.0327	<.0001
High school diploma	0.5504	0.0146	0.6386	0.0064
Some college	0.3932	0.0572	0.5931	0.0058
Less than high school	Reference		Reference	
Income adequacy				
Not reported	0.6356	0.5165	1.8117	0.0686
Neither easy nor difficult	-0.0588	0.6643	0.1893	0.1555
Easy/Very easy	-0.188	0.1952	0.2406	0.0868
Very difficult/Difficult	Reference		Reference	
Device type				
Smartphone	0.2782	0.0233	-0.0279	0.8154
Tablet	-0.1246	0.6123	0.0985	0.6663
Computer	Reference		Reference	

MODEL 3B – OUTCOME 2

MULTINOMIAL MODEL PREDICTING PERCENTAGE OF ALL CANNABIS PRODUCTS CONSUMED IN THE PAST 12 MONTHS FROM LEGAL SOURCES (UNWEIGHTEDN=5835)

F Likelihood ratio (p level): 16.06 (p<.001)

Degrees of freedom: Numerator=58, Denominator=5777

Model max rescaled R2: 0.1708

AIC: 11014.951

	‘SOME’ LEGAL (VS. ‘NONE’)		‘ALL’ LEGAL (VS. ‘NONE’)	
	Beta	P level	Beta	P level
Intercept	-1.0772	0.0005	-0.5559	0.0507
Year				
2019	Reference		Reference	
2020	0.3304	0.0045	0.7879	<.0001
Distance to legal retail store				
< 3km	0.2713	0.0634	0.3016	0.0351
3 to <5 km	0.0987	0.6006	0.0989	0.5924
5 to <10 km	0.0568	0.7363	-0.074	0.6488
10 km or more	Reference		Reference	
Province				
British Columbia	-0.1295	0.4101	-0.076	0.6256
Alberta	0.1072	0.561	0.4541	0.0121
Saskatchewan	0.5379	0.0549	0.8874	0.0009
Manitoba	0.0046	0.9867	0.0804	0.7584
Quebec	0.043	0.7951	0.2267	0.157
New Brunswick and PEI	0.3983	0.0915	0.5265	0.0217
Nova Scotia	0.2562	0.2344	0.4305	0.0416
Nfld & Labrador	1.9311	<.0001	2.5703	<.0001
Ontario	Reference		Reference	
Frequency of use				
< monthly consumer	Reference		Reference	
Monthly consumer	0.5582	0.0012	-0.1969	0.2075
Weekly consumer	1.1349	<.0001	-0.00183	0.9914
Daily consumer	1.0278	<.0001	-0.586	<.0001
Sex				
Female	-0.0299	0.7943	0.2192	0.0513
Male	Reference		Reference	
Age				
21-35	0.8015	<.0001	0.7264	<.0001
36-45	0.4117	0.0118	0.3529	0.0235
46-55	0.3821	0.0185	0.2336	0.1302
56-65	Reference		Reference	
Ethnicity/Race				
Non-white	0.5231	0.0028	0.2357	0.1763

Other/Mixed	0.2147	0.3937	-0.0286	0.9104
White	Reference		Reference	
Education				
Bachelor's degree	0.6615	0.0045	1.0305	<.0001
High school diploma	0.4281	0.0626	0.6164	0.0086
Some college	0.2982	0.1593	0.5545	0.0107
Less than high school	Reference		Reference	
Income adequacy				
Not reported	-0.201	0.7518	-0.0224	0.9694
Neither easy nor difficult	-0.0192	0.8859	0.2005	0.1255
Easy/Very easy	-0.0348	0.8093	0.3072	0.029
Very difficult/Difficult	Reference		Reference	
Device type				
Smartphone	0.3984	0.0011	0.0829	0.4903
Tablet	0.1347	0.5442	0.1513	0.4803
Computer	Reference		Reference	

MODEL 3B – OUTCOME 3

LOGISTIC REGRESSION MODEL PREDICTING LEGAL SOURCE OF 'LAST PURCHASE' OF DRIED FLOWER (UNWEIGHTED N=4,111)

F Likelihood ratio (p level): 12.77 (p<.001)

Degrees of freedom: Numerator=29, Denominator=4082

Model max rescaled R2: 0.1149

AIC: 5823.421

	Beta	Standard error	P level
Intercept	-1.634	0.291	<.0001
Year			
2019	Reference		
2020	0.4573	0.0872	<.0001
Distance to legal retail store			
< 3km	0.2272	0.1138	0.0459
3 to <5 km	0.0333	0.1493	0.8237
5 to <10 km	-0.0439	0.1359	0.7464
10 km or more	Reference		
Province			
British Columbia	-0.076	0.1251	0.5435
Alberta	0.7714	0.1426	<.0001
Saskatchewan	0.7908	0.1982	<.0001
Manitoba	-0.00326	0.1851	0.986
Quebec	0.3824	0.1279	0.0028
New Brunswick and PEI	0.7724	0.1869	<.0001
Nova Scotia	0.6286	0.1692	0.0002
Nfld & Labrador	0.9993	0.2337	<.0001
Ontario	Reference		
Frequency of use			
< monthly consumer	0.6274	0.1197	<.0001
Monthly consumer	0.6694	0.1221	<.0001
Weekly consumer	0.6349	0.1173	<.0001
Daily consumer	Reference		
Sex			
Female	0.0848	0.0858	0.3235
Male	Reference		
Age			
21-35	0.2146	0.1319	0.1038
36-45	0.0726	0.1359	0.5931
46-55	-0.1085	0.141	0.4415
56-65	Reference		
Ethnicity/Race			
Other/Mixed	-0.0908	0.1969	0.6448

White	0.1825	0.1224	0.1358
Non-white	Reference		
Education			
Bachelor's degree	0.5472	0.1778	0.0021
High school diploma	0.2809	0.1771	0.1127
Some college	0.5012	0.1622	0.002
Less than high school	Reference		
Income adequacy			
Not reported	0.5171	0.6226	0.4063
Neither easy nor difficult	0.2869	0.1032	0.0055
Easy/Very easy	0.2084	0.1095	0.0572
Very difficult/Difficult	Reference		
Device type			
Smartphone	0.0483	0.1982	0.8076
Computer	-0.0275	0.1963	0.8886
Tablet	Reference		

Appendix E: Model 4: Output (Consumer perceptions)

MODEL 4 – OUTCOME 1

MULTINOMIAL MODEL PREDICTING PERCENTAGE OF DRIED FLOWER CONSUMED IN THE PAST 12 MONTHS FROM LEGAL SOURCES (UWEIGHTED N=5,056)

F Likelihood ratio (p level): 25.03 (p<.001)

Degrees of freedom: Numerator=86, Denominator=4970

Model max rescaled R2: 0.3952

AIC: 8979.880

	'SOME' LEGAL (VS.' NONE')		'ALL LEGAL' (VS. 'NONE')	
	Beta	P level	Beta	P level
Intercept	-0.6645	0.1156	-0.4424	0.2846
Year				
2019	Reference		Reference	
2020	0.327	0.0049	0.6386	<.0001
Convenience of buying legal marijuana				
More convenient to buy	0.4148	0.015	1.0099	<.0001
Less convenient to buy	-0.7417	<.0001	-1.3232	<.0001
Don't know	-0.2544	0.3607	0.1223	0.6283
No Difference	Reference		Reference	
Quality of legal marijuana				
Higher quality	-0.1027	0.5763	0.0668	0.7204
Lower quality	-0.2807	0.0745	-0.9759	<.0001
Don't know	-1.4458	<.0001	-0.8689	<.0001
No Difference	Reference		Reference	
Price of legal marijuana				
More expensive	-0.2126	0.3024	-0.8471	<.0001
Less expensive	0.1547	0.6565	-0.158	0.649
Don't know	-0.2244	0.4573	-0.2053	0.464
No difference	Reference		Reference	
Safety of using legal marijuana				
Safer to use	0.2526	0.1343	0.5629	0.0016
Less safe to use	0.3982	0.1976	0.5605	0.1302
Don't know	-0.3814	0.1736	0.0113	0.9653
No Difference	Reference		Reference	
Safety of buying legal marijuana				
Safer to buy	0.2855	0.0765	0.5879	0.0007
Less safe to buy	-0.1985	0.5277	0.1527	0.6604
Don't know	0.1993	0.5274	0.2782	0.3414
No Difference	Reference		Reference	

Province				
British Columbia	-0.0947	0.5527	0.1401	0.3959
Alberta	0.312	0.0674	0.5849	0.0007
Saskatchewan	0.4924	0.0856	0.6709	0.0163
Manitoba	0.1663	0.54	0.1895	0.4941
Quebec	0.2641	0.1009	0.3711	0.0249
New Brunswick and PEI	0.5609	0.0141	0.6952	0.0022
Nova Scotia	0.814	0.0009	1.2122	<.0001
Nfld & Labrador	2.0898	<.0001	2.5437	<.0001
Ontario	Reference		Reference	
Frequency of use				
< monthly consumer	Reference		Reference	
Monthly consumer	0.7789	<.0001	0.1892	0.274
Weekly consumer	0.9876	<.0001	-0.1518	0.3744
Daily consumer	1.4249	<.0001	0.1177	0.452
Sex				
Female	-0.1649	0.1622	-0.1994	0.1022
Male	Reference		Reference	
Age				
21-35	0.8601	<.0001	1.144	<.0001
36-45	0.5251	0.0014	0.8216	<.0001
46-55	0.2284	0.1832	0.372	0.0343
56-65	Reference		Reference	
Ethnicity/Race				
Non-white	0.3691	0.0496	-0.1003	0.5987
Other/Mixed	0.5296	0.0268	0.2909	0.2383
White	Reference		Reference	
Education				
Bachelor's degree	0.8187	0.0004	1.0835	<.0001
High school diploma	0.5895	0.0072	0.7295	0.0019
Some college	0.5154	0.0103	0.6499	0.0025
Less than high school	Reference		Reference	
Income adequacy				
Not reported	0.483	0.4184	0.5181	0.362
Neither easy nor difficult	-0.0699	0.603	0.1203	0.3914
Easy/Very easy	-0.2946	0.0461	0.0654	0.6646
Very difficult/Difficult	Reference		Reference	
Rural vs. urban				
Missing	Reference		Reference	
Rural	-0.0929	0.7127	-0.1809	0.4892
Urban	-0.4193	0.0343	-0.5067	0.0135
Device type				
Smartphone	0.1972	0.1089	-0.0924	0.4584
Tablet	-0.0725	0.7702	0.1445	0.5869
Computer	Reference		Reference	

MODEL 4 – OUTCOME 2

MULTINOMIAL MODEL PREDICTING PERCENTAGE OF ALL CANNABIS PRODUCTS CONSUMED IN THE PAST 12 MONTHS FROM LEGAL SOURCES (UNWEIGHTED N=6,629)

F Likelihood ratio (p level): 29.96 (p<.001)

Degrees of freedom: Numerator=86, Denominator=6543

Model max rescaled R2: 0.3741

AIC: 10989.647

	‘SOME’ LEGAL (VS. ‘NONE’)		‘ALL LEGAL’ (VS. ‘NONE’)	
	Beta	P level	Beta	P level
Intercept	0.448	0.2743	0.5799	0.1792
Year				
2019	Reference		Reference	
2020	0.3711	0.0011	0.7158	<.0001
Convenience of buying legal marijuana				
More convenient to buy	0.4035	0.0184	0.9699	<.0001
Less convenient to buy	-0.8604	<.0001	-1.4227	<.0001
Don't know	-0.6507	0.0115	-0.1315	0.5865
No Difference	Reference		Reference	
Quality of legal marijuana				
Higher quality	0.1512	0.4389	0.3641	0.0683
Lower quality	-0.2023	0.1799	-0.9833	<.0001
Don't know	-1.3297	<.0001	-0.9375	<.0001
No Difference	Reference		Reference	
Price of legal marijuana				
More expensive	-0.6028	0.0064	-1.2997	<.0001
Less expensive	-0.1438	0.6828	-0.4319	0.243
Don't know	-0.1137	0.7073	-0.0126	0.9664
No difference	Reference		Reference	
Safety of using legal marijuana				
Safer to use	0.2695	0.0963	0.7185	<.0001
Less safe to use	0.0586	0.8369	0.047	0.8906
Don't know	0.0966	0.6999	0.3653	0.1689
No Difference	Reference		Reference	
Safety of buying legal marijuana				
Safer to buy	0.3054	0.0436	0.533	0.0011
Less safe to buy	0.0968	0.7463	0.2115	0.5312
Don't know	-0.00557	0.9843	0.1538	0.6038
No Difference	Reference		Reference	
Province				
British Columbia	0.0342	0.8277	0.0305	0.8491
Alberta	0.1592	0.3415	0.4093	0.0152

Saskatchewan	0.7532	0.0091	0.9809	0.0005
Manitoba	0.00769	0.9772	-0.0852	0.7623
Quebec	-0.0724	0.6476	-0.0719	0.6626
New Brunswick and PEI	0.2787	0.2446	0.333	0.1838
Nova Scotia	0.2158	0.3341	0.4314	0.0656
Nfld & Labrador	1.837	0.0001	2.273	<.0001
Ontario	Reference		Reference	
Frequency of use				
< monthly consumer	Reference		Reference	
Monthly consumer	0.5804	0.0008	0.0326	0.8434
Weekly consumer	1.0291	<.0001	0.2088	0.2503
Daily consumer	1.1178	<.0001	0.0095	0.9494
Sex				
Female	0.091	0.4362	0.0738	0.5399
Male	Reference		Reference	
Age				
21-35	0.7754	<.0001	0.9401	<.0001
36-45	0.3337	0.0387	0.4844	0.0033
46-55	0.3783	0.0228	0.3918	0.0175
56-65	Reference		Reference	
Ethnicity/Race				
Non-white	0.5255	0.0041	0.2981	0.1149
Other/Mixed	0.4516	0.0639	0.2479	0.3224
White	Reference		Reference	
Education				
Bachelor's degree	0.7667	0.0007	1.084	<.0001
High school diploma	0.475	0.0305	0.6847	0.0042
Some college	0.3807	0.0586	0.6119	0.0055
Less than high school	Reference		Reference	
Income adequacy				
Not reported	-0.0142	0.9784	-0.7111	0.1502
Neither easy nor difficult	-0.1088	0.4113	-0.0202	0.8838
Easy/Very easy	-0.1551	0.2906	0.0488	0.7438
Very difficult/Difficult	Reference		Reference	
Rural vs. urban				
Missing	Reference		Reference	
Rural	-0.4645	0.065	-0.5162	0.0521
Urban	-0.6574	0.0009	-0.6316	0.0024
Device type				
Smartphone	0.3101	0.0114	-0.0127	0.9197
Tablet	0.1346	0.5283	0.1064	0.6345
Computer	Reference		Reference	

MODEL 4 – OUTCOME 3

LOGISTIC REGRESSION MODEL PREDICTING LEGAL SOURCE OF 'LAST PURCHASE' OF DRIED FLOWER (UNWEIGHTED N=4,726)

F Likelihood ratio (p level): 29.27 (p<.001)

Degrees of freedom: Numerator=43, Denominator=4683

Model max rescaled R2: 0.3119

AIC: 5839.052

	Beta	Standard error	P level
Intercept	-1.6328	0.3268	<.0001
Year			
2019	Reference		
2020	0.4007	0.0871	<.0001
Convenience of buying legal marijuana			
More convenient to buy	0.8055	0.1124	<.0001
Less convenient to buy	-0.7762	0.1305	<.0001
Don't know	-0.00847	0.2137	0.9684
No Difference	Reference		
Quality of legal marijuana			
Higher quality	0.1019	0.1237	0.41
Lower quality	-0.515	0.1232	<.0001
Don't know	-0.241	0.1506	0.1097
No Difference	Reference		
Price of legal marijuana			
More expensive	-0.427	0.1366	0.0018
Less expensive	-0.3078	0.2175	0.157
Don't know	0.2138	0.2183	0.3275
No difference	Reference		
Safety of using legal marijuana			
Safer to use	0.5092	0.1206	<.0001
Less safe to use	-0.013	0.2726	0.9621
Don't know	-0.0999	0.2447	0.6831
No Difference	Reference		
Safety of buying legal marijuana			
Safer to buy	0.5317	0.1215	<.0001
Less safe to buy	0.4048	0.2854	0.1561
Don't know	0.0427	0.2793	0.8784
No Difference	Reference		
Province			
British Columbia	0.1192	0.1288	0.3549
Alberta	0.7534	0.1325	<.0001
Saskatchewan	0.6004	0.1966	0.0023

Manitoba	-0.0428	0.1966	0.8276
Quebec	0.2795	0.1283	0.0294
New Brunswick and PEI	0.5584	0.1805	0.002
Nova Scotia	0.7919	0.179	<.0001
Nfld & Labrador	0.8817	0.259	0.0007
Ontario	Reference		
Frequency of use			
< monthly consumer	0.2538	0.1265	0.045
Monthly consumer	0.3363	0.1213	0.0056
Weekly consumer	0.3306	0.1209	0.0063
Daily consumer	Reference		
Sex			
Female	0.0553	0.0892	0.5354
Male	Reference		
Age			
21-35	0.3178	0.1378	0.0212
36-45	0.1924	0.1448	0.1841
46-55	-0.0489	0.1466	0.7385
56-65	Reference		
Ethnicity/Race			
Other/Mixed	0.1323	0.2002	0.509
White	0.2748	0.1297	0.0342
Non-white	Reference		
Education			
Bachelor's degree	0.5123	0.1766	0.0037
High school diploma	0.3131	0.1715	0.0679
Some college	0.4877	0.1596	0.0023
Less than high school	Reference		
Income adequacy			
Not reported	-0.2207	0.3445	0.5218
Neither easy nor difficult	0.2913	0.106	0.006
Easy/Very easy	0.1072	0.1148	0.3506
Very difficult/Difficult	Reference		
Rural vs. urban			
Missing	-0.0603	0.1294	0.6409
Rural	0.3341	0.1553	0.0315
Urban	Reference		
Device type			
Smartphone	-0.0692	0.2075	0.7387
Computer	-0.0461	0.2059	0.8229
Tablet	Reference		

REFERENCES

- 1 Government of Canada. Justice Laws Website: Cannabis Act (S.C. 2018, c.16) 2018.
- 2 Statistics Canada. Cannabis Economic Account, 1961 to 2017 2018. Available from: <https://www150.statcan.gc.ca/n1/daily-quotidien/180125/dq180125c-eng.htm>.
- 3 Mahamad S, Hammond D. Retail price and availability of illicit cannabis in Canada. *Addict Behaviors* 2019;90:402-8.
- 4 Government of Canada. A Framework for the Legalization and regulation of Cannabis in Canada. November 30, 2016. Available from: <https://www.canada.ca/en/health-canada/services/drugs-medication/cannabis/laws-regulations/task-force-cannabis-legalization-regulation/framework-legalization-regulation-cannabis-in-canada.html>
- 5 Government of Canada. Budget 2018. Available from: <https://www.budget.gc.ca/2018/docs/themes/advancement-advancement-en.html>
- 6 Mawani F, Maslov A, Lawrence A. Measuring Illicit Cannabis Seizures in Canada: Methods, Practices and Recommendations. Public Safety Canada; 2017. Available from: <https://www.publicsafety.gc.ca/cnt/rsrscs/pblctns/2017-r002/2017-r002-en.pdf>
- 7 Maslov A, Lawrence J, Ferguson M. Cannabis Performance Metrics for Policy Consideration: What Do We Need to Measure? Public Safety Canada; 2016. Available from: <https://www.publicsafety.gc.ca/cnt/rsrscs/pblctns/2016-r009/2016-r009-en.pdf>
- 8 Keighley K. Police-reported crime statistics in Canada, 2016. Statistics Canada; no. 85-002-X. July 24, 2017. Available from: <https://www150.statcan.gc.ca/n1/pub/85-002-x/2017001/article/54842-eng.htm>
- 9 Statistics Canada. Uniform Crime Reporting Survey (UCR). July 20 2018. Available from: <http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3302>
- 10 Statistics Canada. National Cannabis Survey, Second quarter 2019. Available from: <https://www150.statcan.gc.ca/n1/daily-quotidien/190815/dq190815a-eng.htm>
- 11 Fataar F, Goodman S, Wadsworth E, Hammond D. Consumer perceptions of 'legal' and 'illegal' cannabis in US states with legal cannabis sales. *Addictive Behaviors* 2021; 112: 106563.
- 12 Warner K. The economics of tobacco and health: an overview. In: Abedian I, van der Merwe R, Wilkins N, Jha P, editors. *The economics of tobacco control: towards an optimal policy mix*. Cape Town, South Africa: Applied Fiscal Research Centre, University of Cape Town and World Bank; 1998. p. 57-75.
- 13 International Agency for Research on Cancer. IARC Handbooks of Cancer Prevention, Tobacco Control, Volume 14: Effectiveness of Tax and Price Policies in Tobacco Control. Lyon, France: International Agency for Research on Cancer; 2011.
- 14 US National Cancer Institute and World Health Organization. *The Economics of Tobacco and Tobacco Control*. National Cancer Institute Tobacco Control Monograph 21. NIH Publication No. 16-CA-8029A. Bethesda, MD: US Department of Health and Human Services, National Institutes of Health, National Cancer Institute; and Geneva: World Health Organization; 2016.
- 15 Pacula RL, Lundberg R. Why changes in price matter when thinking about marijuana policy: A review of the literature on the elasticity of demand. *Public Health Reviews* 2014; 35(2):1-18.
- 16 US Department of Health and Human Services. *The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General*. Atlanta: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2014. Available at: http://www.cdc.gov/tobacco/data_statistics/sgr/50th-anniversary/index.htm

-
- 17 Government of Canada. What industry needs to know about cannabis. 2019. Available from: <https://www.canada.ca/en/services/health/campaigns/cannabis/industry.html>
 - 18 Government of Canada. Regulations Amending the Cannabis Regulations (New Classes of Cannabis): SOR/2019-206. Canada Gazette, Part II, Volume 153, Number 13. Available from: <http://www.gazette.gc.ca/rp-pr/p2/2019/2019-06-26/html/sor-dors206-eng.html>
 - 19 Statistics Canada. The Retail Cannabis Market in Canada: A Portrait of the First Year. Available from: <https://www150.statcan.gc.ca/n1/pub/11-621-m/11-621-m2019005-eng.htm>
 - 20 Salomonsen-Sautel S, Sakai JT, Thurstone C, Corley R, Hopfer C. Medical marijuana use among adolescents in substance abuse treatment. *Journal of the American Academy of Child and Adolescent Psychiatry* 2012; 51: 694–702.
 - 21 Thurstone C, Lieberman SA, Schmieg SJ. Medical marijuana diversion and associated problems in adolescent substance treatment. *Drug and Alcohol Dependence* 2011; 118: 489–492. 1
 - 22 U.S. Department of Health and Human Services. Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General, Chapter 5. National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. Atlanta (GA): Centers for Disease Control and Prevention; 2012.
 - 23 Pokorny SR, Jason LA, Schoeny ME. The relation of retail tobacco availability to initiation and continued smoking. *Journal of Clinical Child and Adolescent Psychology* 2003; 32(2): 193-204.
 - 24 Sherk A, Stockwell T, Chikritzhs T, Andréasson S, Angus C, Gripenberg J, Holder H, Holmes J, Mäkelä P, Mills M, Norström T, Ramstedt M, Woods J. Alcohol consumption and the physical availability of take-away alcohol: Systematic reviews and meta-analyses of the days and hours of sale and outlet density. *Journal of Studies on Alcohol and Drugs* 2018; 79: 58-67.
 - 25 Statistics Canada. National Cannabis Survey, third quarter 2019. 2019. Available from: <https://www150.statcan.gc.ca/n1/daily-quotidien/191030/dq191030a-eng.htm>.
 - 26 Hathaway A, Cullen G, Walters D. How well is cannabis legalization curtailing the illegal market? A multi-wave analysis of Canada's National Cannabis Survey. *Journal of Canadian Studies* 2021;55(2):307-36.
 - 27 Hammond D, Goodman S, Wadsworth E, Rynard V, Boudreau C, Hall W. Evaluating the impacts of cannabis legalization: The International Cannabis Policy Study. *International Journal of Drug Policy* 2020; 77: 102698.
 - 28 Goodman, S, Burkhalter, R, Hammond, D. International Cannabis Policy Study Technical Report - Wave 2 (2019). Available from: <http://cannabisproject.ca/methods>
 - 29 Goodman, S, Burkhalter, R, Hammond, D. International Cannabis Policy Study Technical Report - Wave 3 (2020). Available from: <http://cannabisproject.ca/methods>
 - 30 Hammond D, Goodman S, Wadsworth E, Freeman T, Kilmer B, Schauer G, Pacula R, Hall WG. Trends in the use of cannabis products in Canada and the USA, 2018 – 2020: Findings from the International Cannabis Policy Study. Under review.
 - 31 Statistics Canada. Consumer Price Index, September 2020. Available from: <https://www150.statcan.gc.ca/n1/daily-quotidien/201021/dq201021a-eng.htm>]
 - 32 Martin B. Price averages for Canadian cannabis by province. Leafly; October 30, 2019. Available from: <https://www.leafly.ca/news/strains-products/canada-price-averages>
 - 33 Alberta Gaming Liquor Commission. Cannabis Licensee search. [Internet] 2021. Available from: <https://aglc.ca/cannabis/retail-cannabis/cannabis-licensee-search>
 - 34 Alcohol and Gaming Commission of Ontario. Status of current cannabis retail store applications. [Internet]. 2021. Available from: <https://www.agco.ca/status-current-cannabis-retail-store-applications>
 - 35 Statistics Canada. Estimates of population as of July 1st, by marital status or legal marital status, age and sex. Table 17-10-0060-01. [Internet] 2021. Available from: <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710006001>

-
- 36 Statistics Canada. Postal Code Conversion File Plus (PCCF+). [Internet] 2020. Available from: <https://www150.statcan.gc.ca/n1/en/catalogue/82F0086X>.
- 37 Pinault L, Khan S, Tjepkema M. Accuracy of matching residential postal codes to census geography. *Health Reports* 2020;31:3-13.
- 38 Bow CJD, Waters NM, Faris PD, Seidel JE, Galbraith D, Knudtson ML, et al. Accuracy of city postal code coordinates as a proxy for location of residence. *International Journal of Health Geographics* 2004;3:1-9.
- 39 Statistics Canada. Analysis in brief: The retail cannabis market in Canada: A portrait of the first year. [Internet] 2019. Available from: <https://www150.statcan.gc.ca/n1/pub/11-621-m/11-621-m2019005-eng.htm>
- 40 Wadsworth E, Driezen P, Hammond D. Retail availability and legal purchases of dried flower in Canada post-legalization. *Drug and Alcohol Dependence* 2021; 225: 108794.
- 41 Ontario Cannabis Store. A Year in Review: April 1 2020 – March 31 2020. Available from: <https://ocs.ca/pages/insights-publication>
- 42 SQDC. Annual Report 2020. Available from: https://numerique.banq.qc.ca/patrimoine/details/52327/4126714?docref=6Bi1D_BOnHbf_jUYwFPtZg
- 43 Statistics Canada. Table 17-10-0060-01 Estimates of population as of July 1st, by marital status, age and sex. Doi: 10.25318/1710006001-eng.
- 44 Government of Canada. Dried cannabis market data – Table 1 Dried cannabis packaged units (sales). Available from: <https://www.canada.ca/en/health-canada/services/drugs-medication/cannabis/research-data/market/dried.html#tbl-2>
- 45 Ontario Cannabis Store. A Year in Review: 2019-2020. 2020. Available from: https://cdn.shopify.com/s/files/1/2636/1928/files/OCS-InsightsReport_2019-2020_8f607a7b-21b0-4718-adb3-7cd60a2f08ea.pdf?v=1608224707.
- 46 Société Québécoise du Cannabis. Annual Report 2020. 2020. Available from: <https://www.sqdc.ca/en-CA/about-the-sqdc/acces-to-information/Publications>
- 47 Rotermann M. Looking back from 2020, how cannabis use and related behaviours changed in Canada. *Health Reports* 2021;32(4):3-14.
- 48 Statistics Canada. National Cannabis Survey, third quarter 2019. 2019. Available from: https://www150.statcan.gc.ca/n1/daily-quotidien/191030/dq191030a-eng.htm?utm_source=Canadian+Public+Health+Association&utm_campaign=66fe936314-EMAIL_CAMPAIGN_2019_10_25_01_17&utm_medium=email&utm_term=0_1f88f45ba0-66fe936314-154369271
- 49 Government of Canada. Canadian Cannabis Survey 2019 – Summary. 2019. Available from: <https://www.canada.ca/en/health-canada/services/publications/drugs-health-products/canadian-cannabis-survey-2019-summary.html>.
- 50 Government of Canada. Canadian Cannabis Survey 2020: Summary. 2020. Available from: <https://www.canada.ca/en/health-canada/services/drugs-medication/cannabis/research-data/canadian-cannabis-survey-2020-summary.html>.
- 51 Statistics Canada. StatsCannabis data availability: Crowdsourced cannabis prices, fourth quarter 2019. 2020. Available from: <https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5263>
- 52 Wadsworth E, Driezen P, Kilmer B, Pacula R, Hammond D. Trends in price and purchase sources in the dried flower cannabis market in the United States, 2019-2020. Manuscript under review.
- 53 Statistics Canada (2019b). National Cannabis Survey, second quarter 2019. Available from <https://www150.statcan.gc.ca/n1/daily-quotidien/190815/dq190815a-eng.htm>.
- 54 Caulkins JP, Pardo B, Kilmer B. Intensity of cannabis use: Findings from three online surveys. *International Journal of Drug Policy* 2020;79:102740.

-
- 55 Owusu-Bempah A, Luscombe A. Race, cannabis and the Canadian war on drugs: An examination of cannabis arrest data by race in five cities. *International Journal of Drug Policy* 2021;91:102937.
- 56 Fataar F, Driezen P, Owusu-Bempah O, Hammond D. Cannabis-related arrests and convictions in Canada: Differences by race/ethnicity, individual socioeconomic factors and neighbourhood deprivation. Manuscript under review.
- 57 Rotermann M. What has changed since cannabis was legalized? *Health Reperports* 2020;31(2):11-20.
- 58 Armstrong MJ. Legal cannabis market shares during Canada's first year of recreational legalisation. *International Journal of Drug Policy* 2021;88:103028.
- 59 Statistics Canada. The retail cannabis market in Canada: A portrait of the first year. 2019 [Available from: <https://www150.statcan.gc.ca/n1/pub/11-621-m/11-621-m2019005-eng.htm>]
- 60 Statistics Canada. Analysis in brief: The retail cannabis market in Canada: A portrait of the first year. [Internet] 2019. Available from: <https://www150.statcan.gc.ca/n1/pub/11-621-m/11-621-m2019005-eng.htm>
- 61 Myran DT, Brown CR, Tanuseputro P. Access to cannabis retail stores across Canada 6 months following legalization: a descriptive study. *Canadian Medical Association Journal - Open* 2019;7, E454.
- 62 Wadsworth E, Driezen P, Kilmer B, Pacula R, Hammond. Trends in price and transitions to legal purchase sources in Canada's dried flower cannabis market in the two years after legalization of non-medical cannabis. Manuscript under review.
- 63 Berg CJ, Henriksen L, Cavazos-Rehg PA, Haardoerfer R, Freisthler B. The emerging marijuana retail environment: Key lessons learned from tobacco and alcohol retail research. *Addictive Behaviors* 2018;81, 26-31.
- 64 Freisthler B, Gruenewald PJ. Examining the relationship between the physical availability of medical marijuana and marijuana use across fifty California cities. *Drug & Alcohol Dependence* 2014;143, 244-50.
- 65 Loriggio P. Delays in Ontario cannabis delivery could push consumers back to black markets. [Internet] The Canadian Press. 2018 October 25. Available from: <https://www.ctvnews.ca/business/delays-in-ontario-cannabis-delivery-could-push-consumers-back-to-black-market-critics-1.4149799>.
- 66 Leafly Canada Staff. Ontario Cannabis Store launches same-day delivery. [Internet] Leafly. 2019. Available from: <https://www.leafly.ca/news/industry/ocs-same-day-delivery>.
- 67 Vincent PC, Collins RL, Liu L, Yu J, De Leo JA, Earleywine M. The effects of perceived quality on behavioral economic demand for marijuana: A webbased experiment. *Drug and Alcohol Dependence* 2017; 170: 174-180.
- 68 Fataar F, Goodman S, Wadsworth E, Hammond D. Consumer perceptions of 'legal' and 'illegal' cannabis in US states with legal cannabis sales. *Addictive Behaviors* 2021; 112: 106563.
- 69 Statistics Canada. National Cannabis Survey, fourth quarter 2018; 2019. Retrieved from <https://www150.statcan.gc.ca/n1/daily-quotidien/190207/dq190207b-eng.htm>.
- 70 Statistics Canada. National Cannabis Survey, second quarter 2019; 2020. Retrieved from <https://www150.statcan.gc.ca/n1/daily-quotidien/190815/dq190815a-eng.htm>.
- 71 Hammond D. COVID19 and substance use in Canada. Health Canada - Public Education Partnership Symposium on Substance Use; 2021 May 6. [Online]
- 72 Marijuana Policy Group. Cannabis demand in Canada, draft version 18. report commissioned by Health Canada from Marijuana Policy Group and BOTECH Analysis. (2018).
- 73 Armstrong MJ. Canada's provinces and territories should disclose cannabis data to support research. *Canadian Medical Association Journal* 2021;193(10):E341-E2.