



Home cultivation across Canadian provinces after cannabis legalization

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ABSTRACT

Aims: Little research exists on home cultivation in Canada after non-medical cannabis legalization in 2018. The aims of the study were to: (1) estimate the percentage of home cultivation before and after legalization; (2) estimate the quantity and expenditure of cannabis plants; and (3) examine the association between provincial policies and home cultivation after legalization.

Methods: Repeat cross-sectional survey data come from Canadian respondents in the International Cannabis Policy Study in 2018, 2019, and 2020. Respondents aged 16–65 were recruited through online commercial panels. Home cultivation rates were estimated among all respondents in 2019 and 2020 ($n = 26,304$) and among a sub-sample of past 12-month cannabis consumers in 2018–2020 ($n = 12,493$). Weighted multivariable logistic regression models examined the association between home cultivation and provincial policies among all respondents, 2019–2020.

Results: Cannabis consumers in 2019 (7.9%; AOR = 1.47, 95% CI: 1.07, 2.01) and 2020 (8.8%; AOR = 1.62, 95% CI: 1.18, 2.23) had higher odds of reporting home cultivation in the past 12 months than pre-legalization (5.8%). Post-legalization, past 12-month home cultivation was lower in Quebec and Manitoba, the two provinces that prohibited home cultivation (3.2%), than in provinces where home cultivation was permitted (6.8%; AOR = 0.48, 95% CI: 0.39, 0.59). The median number of plants grown across all provinces was between 3.1 and 3.5 in all years.

Conclusions: Almost one in ten Canadian cannabis consumers reported home cultivation of cannabis in 2020, with modest increases following legalization and most growing within the non-medical limit of four plants. Home cultivation was less common in provinces where home cultivation was prohibited.

1. Introduction

On October 17, 2018, Canada became the second country in the world to legalize non-medical cannabis (Government of Canada, 2018). Briefly, the Cannabis Act permits adults aged 18 and over to purchase cannabis, cultivate up to four plants, and possess up to 30 g of dried flower (or equivalent, e.g., 30 cannabis seeds) in public (Government of Canada, 2018). Canadians can access legal non-medical cannabis through physical and online retail stores, sharing small amounts among friends and family, or growing personal cannabis plants (home cultivation).

Prior to the legalization of non-medical cannabis in 2018, home cultivation was permitted for consumers with medical authorization under certain conditions (Fischer, Murphy, Kurdyak, Goldner, & Rehm, 2015; Government of Canada, 2016). Those with medical authorization

were permitted to grow their own cannabis; or designate someone to grow cannabis on their behalf (Fischer et al., 2015; Walsh et al., 2013). In October 2018; immediately prior to legalization of non-medical cannabis, less than 1% of Canadians were registered with Health Canada for medical cannabis and 7.5% of Canadians with medical authorization had an active registration to grow or designate someone to grow on their behalf (Government of Canada, 2020; Statistics Canada, 2021). In October 2020; approximately two years after non-medical legalization, this percentage had risen to 11.3% (Government of Canada, 2020).

Under the Cannabis Act, unchanged from the preceding “Access to Cannabis for Medical Purposes” regulations, the number of plants grown for medical consumption is determined by the daily quantity of cannabis outlined in the patient’s medical authorization (Government of Canada, 2016, 2021). In general, for every gram of dried flower authorized, five plants are permitted indoors or two outdoors (Government of Canada,

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2016, 2021). For instance, if the patient is authorized two grams of dried flower per day, ten plants would be permitted indoors. Therefore, Canadians growing for medical purposes may have higher limits of the number of plants grown than Canadians growing for non-medical purposes (four plant limit) (Canadian Centre on Substance Use and Addiction, 2020). Moreover, provinces and territories have jurisdiction on retail sales and distribution, including prohibiting home cultivation, and so regulations vary across the country (Canadian Centre on Substance Use and Addiction, 2020). For example, Manitoba and Quebec prohibit home cultivation of non-medical cannabis, whereas all other provinces allow up to four plants (Canadian Centre on Substance Use and Addiction, 2020).

In a legal market, allowing residents to grow their own cannabis at home provides a relatively low-cost source of cannabis for those who prefer not to purchase from retail stores or pay taxes, to have more control over cannabis strains, or for those growing for enjoyment (Caulkins, Kilmer, & Kleiman, 2016; Transform Drugs Policy Foundation, 2016; Government of Canada, 2016). Indeed, home cultivation could support the objectives of the Cannabis Act, if those growing a personal supply are doing so instead of sourcing illegally (Caulkins et al., 2016; Transform Drugs Policy Foundation, 2016). Conversely, home cultivation has the potential to undermine objectives of the Cannabis Act, which include reducing the illegal market and prevent underage consumption (Government of Canada, 2018). Home cultivation could provide easier access to children in the home, allow opportunity for illegal resale, and avoid the strict regulations that were created to protect public health (Azofeifa, Pacula, & Mattson, 2021; Government of Canada, 2018). Further research is needed on home cultivation in Canada since legalization, including who grows their own cannabis plants.

When compared to other supply sources such as friends and family or retail stores, home cultivation rates have been found to be comparably modest, both before and after legalization (Government of Canada, 2017; Rotermann, 2021). In the National Cannabis Survey; 8.0% of past three-month cannabis consumers reported getting their cannabis by growing their own or someone growing it for them before legalization in the first quarter of 2018 (Rotermann, 2021). In the first quarter of 2019; 9.0% reported past three-month home cultivation, which significantly increased to 14.2% in the fourth quarter of 2020 (Rotermann, 2021). Similar percentages of home cultivation were found in the Canadian Cannabis Survey among past 12-month consumers: 5.6% reported growing their own cannabis before legalization in 2018; compared to 9.0% and 15.3% after legalization in 2019 and 2020, respectively (Government of Canada, 2019, 2017, 2018, 2020). In 2020; the Canadian Cannabis Survey also reported home cultivation among Canadians who were not cannabis consumers in the past 12-months: 3.3% of non-consumers reported home cultivation in the home in 2020 (Government of Canada, 2020). However; neither survey examined how home cultivation varies by cultivation policies.

Previous research conducted in the United States (U.S.) examined individual and U.S. state characteristics associated with home cultivation (Azofeifa et al., 2021; Borodovsky & Budney, 2017; Nguyen, Malm, & Bouchard, 2015). In a study examining individual characteristics of home cultivation among U.S. adults, approximately 2% of past-year consumers aged 21 and older reported growing cannabis between 2010 and 2014 (Azofeifa et al., 2021). Growing cannabis was significantly higher among males, those living in rural areas, and more frequent cannabis consumers. Three studies conducted in the U.S. examined the association between state legislation and home cultivation rates (Azofeifa et al., 2021; Borodovsky & Budney, 2017; Nguyen et al., 2015). In general, states with more permissive cannabis laws (e.g., medical cannabis laws, permitting home cultivation) had higher rates of respondents growing their own cannabis, demonstrating the impact of policy on individuals' propensity to grow cannabis at home. To our knowledge, there is no research to date on the variation of home cultivation rates across the provinces in Canada after legalization.

Research on non-medical home cultivation in Canada since non-medical cannabis legalization is nascent. To our knowledge, the current study is among the first to examine provincial policies and home cultivation among Canadians since legalization. The aims of the study were to: (1) estimate the percentage of Canadians who reported growing cannabis plants in 2019 and 2020 as well as past 12-month cannabis consumers who reported growing cannabis plants in 2018, 2019, and 2020; (2) estimate the quantity of plants and expenditure of cannabis plants/seeds; and (3) examine the association between provincial policies, cannabis use status, and home cultivation in 2019 and 2020.

2. Methods

Data are from Waves 1–3 of the International Cannabis Policy Study (ICPS), repeat cross-sectional surveys conducted in Canada and the U.S. Data were collected via self-completed web-based surveys before legalization in August–October 2018, and after legalization in September–October in 2019 and 2020 from respondents aged 16–65. A non-probability sample of respondents was recruited through the Nielsen Consumer Insights Global Panel and their partners' panels. For the ICPS surveys, Nielsen draws stratified random samples from the online panels, with quotas based on age and state/province of residence. Nielsen emails panelists an invitation to access the ICPS survey via a hyperlink; respondents are unaware of the survey topic prior to accessing the link. Respondents confirm their eligibility and provide consent before completing the survey. Upon completion, respondents are transferred back to the Nielsen platform and receive remuneration in accordance with their panel's usual incentive structure. Monetary incentives have been shown to increase response rates and decrease response bias in subgroups under-represented in surveys, including disadvantaged subgroups (Groves et al., 2009).

Surveys were conducted in English or French. Median survey time was 20 min in 2018, 25 min in 2019, and 21 min in 2020. Data integrity measures include checks for 'speeders' based on completion times, the quality of open-ended responses, patterns of 'Don't Know/Refusal' responses, and inconsistent responses across items (American Association of Public Opinion Research (AAPOR), 2018).

The current study reports data from the Canadian sample only. In 2018, 17,157 Canadian respondents accessed the survey link, of whom 10,646 completed the entire survey for an AAPOR cooperation rate of 62% (American Association for Public Opinion Research, 2016). In 2019, 24,607 respondents accessed the survey link, of whom 17,513 completed the entire survey (63%) and in 2020, 25,827 respondents accessed the survey link, of whom 17,001 completed the entire survey (66%) (American Association for Public Opinion Research, 2016).

The study was reviewed by and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#31330). A full description of the study methods can be found in the ICPS Technical Reports and methodology paper (Goodman & Hammond, 2019; Goodman, Burkhalter, & Hammond, 2020a; Goodman, Burkhalter, & Hammond, 2020b; Hammond et al., 2020).

2.1. Measures

2.1.1. Socio-demographic measures

Sex at birth, age, ethnicity/race, highest education level, perceived income adequacy, suspected device type used to complete survey, and province of residence. For "perceived income adequacy", those who answered, "Don't know" or "Refuse to answer" were categorized to "Not stated". See Table 1 for response options.

2.1.2. Rural/Urban status

Respondents were asked "Please provide the postal code where you live for most of the year". If respondents did not provide their postal code ($n_{2018} = 1049$; $n_{2019} = 2900$; $n_{2020} = 2934$), they were asked "Please name the 2 cross-streets of this intersection". Of those who

Table 1
Unweighted and weighted sample characteristics of Canadians in 2019, and 2020 (n = 31,036).

	Unweighted % (n)		Weighted % (n)	
	2019 n = 15,256	2020 n = 15,780	2019 n = 15,256	2020 n = 15,780
Age group				
16–25	14.8 (2251)	16.5 (2607)	18.8 (2867)	18.7 (2946)
26–35	18.8 (2863)	16.5 (2608)	20.9 (3192)	21.1 (3328)
36–45	20.3 (3102)	18.8 (2972)	19.8 (3014)	20.0 (3156)
46–55	20.8 (3165)	20.3 (3197)	19.9 (3038)	19.4 (3068)
56–65	25.4 (3875)	27.9 (4396)	20.6 (3147)	20.8 (3282)
Sex				
Female	61.4 (9373)	62.0 (9782)	49.7 (7583)	49.7 (7843)
Male	38.6 (5883)	38.0 (5998)	50.3 (7673)	50.3 (7937)
Ethnicity				
Black	2.9 (441)	2.7 (420)	3.7 (560)	3.6 (567)
East/Southeast Asian	7.4 (1132)	8.4 (1318)	7.8 (1189)	9.0 (1419)
Indigenous	2.2 (338)	2.1 (325)	2.3 (353)	1.9 (299)
Latinx	1.2 (184)	1.3 (210)	1.4 (220)	1.8 (290)
Middle Eastern	1.2 (180)	1.6 (246)	1.3 (198)	1.8 (286)
South Asian	2.8 (421)	3.1 (496)	3.3 (497)	3.7 (586)
White	76.2 (11,617)	74.1 (11,700)	73.2 (11,161)	71.0 (11,206)
Other/Mixed	6.2 (943)	6.8 (654)	7.1 (1079)	7.2 (1128)
Education				
Less than high school	8.2 (1241)	10.4 (1624)	15.6 (2355)	15.5 (2413)
High school diploma	16.7 (2516)	15.5 (2425)	26.8 (4035)	26.8 (4173)
Some college or technical vocation	42.3 (6382)	40.2 (6268)	32.7 (4936)	32.8 (5103)
Bachelor's degree or higher	32.9 (4968)	33.9 (5284)	24.9 (3755)	24.9 (3882)
Income adequacy				
Very difficult	9.1 (1382)	7.2 (1132)	9.6 (1469)	7.6 (1198)
Difficult	21.8 (3332)	18.4 (2895)	22.1 (3375)	18.4 (2899)
Neither easy nor difficult	35.0 (5333)	37.4 (5908)	34.9 (5325)	37.4 (5897)
Easy	20.7 (3161)	22.3 (3519)	19.7 (3000)	21.9 (3452)
Very Easy	10.1 (1540)	11.2 (1770)	9.5 (1455)	10.7 (1682)
Not stated	3.3 (508)	3.5 (556)	4.1 (631)	4.1 (653)
Cannabis use frequency				
Never	37.7 (5754)	38.7 (6105)	38.0 (5799)	39.3 (6208)
Used more than 12 months ago	29.1 (4433)	29.6 (4664)	26.7 (4076)	26.6 (4194)
Past-year but less than monthly	11.8 (1795)	10.7 (1685)	11.3 (1729)	10.2 (1610)
Monthly	6.4 (978)	5.9 (935)	7.0 (1064)	6.4 (1008)
Weekly	5.3 (803)	5.2 (812)	5.7 (863)	5.7 (896)
Daily/almost daily	9.8 (1493)	10.0 (1579)	11.3 (1724)	11.8 (1863)
Province of residence				
British Columbia	14.5 (2211)	15.4 (2432)	13.7 (2094)	13.8 (2173)

Table 1 (continued)

	Unweighted % (n)		Weighted % (n)	
	2019 n = 15,256	2020 n = 15,780	2019 n = 15,256	2020 n = 15,780
Alberta	14.4 (2200)	15.1 (2378)	11.9 (1813)	11.9 (1874)
Saskatchewan	5.5 (843)	5.9 (924)	3.0 (464)	3.0 (476)
Manitoba	5.8 (877)	5.9 (931)	3.6 (547)	3.6 (563)
Ontario	21.7 (3315)	21.0 (3318)	39.2 (5983)	39.3 (6205)
Quebec	23.7 (3612)	18.2 (2864)	22.2 (3387)	22.1 (3494)
New Brunswick	4.6 (697)	5.9 (934)	2.0 (308)	2.0 (316)
Nova Scotia	5.6 (855)	5.9 (931)	2.6 (390)	2.5 (401)
Prince Edward Island	1.0 (145)	1.4 (226)	0.4 (62)	0.4 (65)
Newfoundland & Labrador	3.3 (501)	5.3 (842)	1.4 (209)	1.4 (213)
Device used				
Smartphone	42.6 (6499)	45.2 (7132)	42.8 (6529)	45.4 (7169)
Tablet	10.2 (1555)	5.7 (891)	9.5 (1445)	5.2 (812)
Computer	47.2 (7202)	49.2 (7757)	47.7 (7282)	49.4 (7799)

Sex at birth and gender were collected separated in the survey; however, sex at birth was included in order to retain all respondents (gender included missing data and very small cell sizes for non-cis individuals, which could not be included in analyses). Income adequacy is assessed by the question: "Thinking about your family's income, how difficult or easy is it to make ends meet?", where 'making ends meet' means having enough money to pay for the things your family needs.

provided their intersection ($n_{2018} = 298$; $n_{2019} = 1081$; $n_{2020} = 1068$), Google Maps was used to obtain postal codes, cross-referencing with the respondents' city and province. All intersections where Google Maps could not find a postal code were left blank ($n_{2018} = 210$; $n_{2019} = 272$; $n_{2020} = 61$). The Canadian respondents' postal codes were linked to the Postal Code Conversion File Plus (PCCF+) version 7B (2018, 2019) and 7C (2020), to obtain the rural/urban status of respondent's postal codes (Statistics Canada, 2019).

2.1.3. Cannabis use status

Cannabis use status was categorized to: "Non-consumer" (Never; Consumed more than 12 months ago), "Non-daily consumer" (Less than monthly consumer but used in the past 12 months; Monthly consumer; Weekly consumer), and "Daily consumer" (Daily or almost daily consumer).

2.1.4. Home cultivation measures

In 2018, past 12-month cannabis consumers were asked, "Did you grow any marijuana plants in the past 12 months?" (Yes, No). Those who answered, "Don't know" were categorized to "No". In 2019 and 2020, the same question was asked to all respondents. Those who answered "Yes" to growing plants in the past 12 months were asked the following two questions: "In total, how many marijuana plants did you grow in the past 12 months?" and "In total, how much money did you spend on all the marijuana plants or seeds you bought in the past 12 months?" Both questions were open-ended for numerical answers. Extreme values/outliers were excluded (i.e., respondents who grew over 1000 plants [$n = 3$] as well as respondents who obtained their plants/seeds for free ($n = 4$)).

2.1.5. Medical cannabis authorization

Respondents who had ever received authorization for medical cannabis were asked, "Were you authorized to use medical marijuana at any time in the past 12 months?" (Yes, No). All respondents who had

never received authorization or answered, “Don’t know” were categorized as “No”.

2.1.6. Non-medical cultivation policies

A binary variable was created for provinces that prohibited home cultivation and those that permitted home cultivation after legalization in 2019 and 2020. At the time of survey, Manitoba and Quebec prohibited home cultivation, and all other provinces did not.

2.1.7. Average price per plant

The average price per plant was calculated by dividing the amount of money spent on all cannabis plants/seeds in the past 12 months by the number of plants grown in the past 12 months.

All questions included “Don’t know” and “Refuse to answer” options. All “Don’t know” and “Refuse to answer” options were excluded unless specified within the measures above.

2.2. Statistical analysis

After exclusions due to poor data quality, such as speeding, dishonesty, or duplicate entries ($n = 3038$), the final Canadian cross-sectional samples comprised of 10,057 respondents in 2018, 15,256 in 2019, and 15,780 in 2020. See Technical Reports for more detail on exclusions (Goodman & Hammond, 2019; Goodman et al., 2020a; Goodman et al., 2020b; Hammond et al., 2020).

Analyses on 2018–2020 data was conducted on the sub-sample of Canadian respondents who had consumed cannabis in the past 12-months. For analyses including only 2019 and 2020 data, all Canadian respondents—including non-consumers—were included. Missing data were removed using case-wise deletion for three variables used in regression models using 2019 and 2020 data: home cultivation ($n = 42$); rural/urban status ($n = 4627$); and highest level of education ($n = 328$). A sensitivity analysis was conducted where rural/urban status was removed from regression models.

Post-stratification sample weights were constructed based on the Canadian Census estimates. In 2018, respondents were classified into age-by-sex-by-province and education groups. In 2019 and 2020, respondents were classified into age-by-sex-by-province, education, and age-by-smoking cigarette status groups. 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 all years in Canada. Estimates are weighted unless otherwise specified.

First, descriptive statistics were used to describe the percentage of respondents who grew their own cannabis plants in the past 12 months. Second, the mean and median number of plants and amount spent on plants in the past 12 months were estimated across year. Third, multivariable logistic regression models were fitted to examine the association between home cultivation and provincial policies and individual characteristics among respondents in 2019 and 2020. Provincial policies were represented in two ways: (1) province of residence; (2) whether home cultivation was prohibited. All models were adjusted for rural/urban status, age, sex, education level, ethnicity/race, income adequacy, survey device type, and cannabis use status. Adjusted odds ratios (AORs) are reported with 95% confidence intervals (95% CI). Analyses were conducted using survey procedures in SAS (SAS version 9.4, SAS Institute Inc., Cary, NC, USA).

3. Results

Table 1 displays the unweighted and weighted sample characteristics of respondents in 2019 and 2020. Supplemental Table 1 displays the unweighted and weighted sample characteristics of past 12-month cannabis consumers in 2018, 2019, and 2020. For both samples, half of respondents were male, and three-quarters were white.

3.1. Home cultivation among past 12-month cannabis consumers: 2018–2020

Table 2 displays home cultivation practices among past 12-month cannabis consumers in Canada in 2018, 2019 and 2020. A total of 5.8%, 7.9%, and 8.8% of past 12-month consumers reported growing cannabis plants in the past 12-months in 2018, 2019, and 2020, respectively. Among those that grew cannabis plants, the median number of plants grown was between 3.3 and 3.5 in all years. Among respondents who grew plants, 42.3% reported growing more than four plants in 2018 compared to 24.5% in 2020 ($\chi^2 = 12.0$, $p = 0.003$). The median price paid per plant grown in the past 12 months was \$18.08 in 2018, \$14.49 in 2019, and \$15.87 in 2020.

A multivariable logistic regression model examined the association between home cultivation among cannabis consumers and survey year, adjusting for province of residence, rural/urban status, medical authorization, and sociodemographic characteristics. Past 12-month cannabis consumers in 2019 (AOR = 1.47, 95% CI: 1.07, 2.01) and 2020 (AOR = 1.62, 95 %CI: 1.18, 2.23) had higher odds of reporting home cultivation in the past 12 months than those in 2018.

3.2. Home cultivation among all respondents in 2019 and 2020

Table 2 displays the home cultivation practices among all respondents (consumers and non-consumers) in 2019 and 2020. A total of 5.7% and 6.1% respondents grew cannabis plants in the past 12-months in 2019 and 2020, respectively. Among those that grew cannabis plants, the median number of plants grown in the past 12-months was 3.1 in 2019 and 2020. In both years, around three-quarters of respondents who grew cannabis plants, grew four plants or fewer in the past 12 months. In both years, the median amount of money spent on plants/seeds in the past 12-months was approximately \$60. The median price per plant grown in the past 12-months was \$14.05 in 2019 and \$15.05 in 2020.

3.3. Province of residence

Fig. 1 displays the percentage of respondents in 2019 and 2020 who reported growing cannabis plants in the past 12-months by province and retail structure. In 2020, Nova Scotia reported the highest percentage of respondents that grew cannabis plants (9.9%), whereas Manitoba reported the lowest (2.6%). Provinces with public retail structure, i.e., a government-run retail structure, reported the highest and lowest percentages of home cultivation, whereas provinces with private and hybrid of private and public retail structures were in between.

A multivariable logistic regression model examined the correlates of home cultivation in the past 12 months (Table 3; Left column). Respondents in Ontario, Nova Scotia, New Brunswick, and British Columbia had higher odds of reporting home cultivation in the past 12-months than respondents in Quebec.

After adjusting for province and survey year, respondents living in rural areas had higher odds of home cultivation in the past 12 months than those in urban areas. Non-daily and daily cannabis consumers had higher odds of home cultivation than non-consumers. Respondents with authorization for medical cannabis in the past 12-months had higher odds of home cultivation than those without authorization. East/South East Asian respondents and respondents aged 16–25 had lower odds of home cultivation in the past 12-months. Black respondents had higher odds of home cultivation in the past 12-months.

3.4. Non-medical cultivation policies

A multivariable logistic regression model examined the association between home cultivation and cultivation policies (Table 3; Right column). Respondents in provinces that prohibited cultivation (Manitoba, Quebec) had lower odds of reporting home cultivation in the past 12 months (AOR = 0.48, 95 %CI: 0.39, 0.59). Similar patterns emerged for

Table 2
Home cultivation among past 12-month and all consumers in Canada: 2018, 2019, and 2020.

	2018		2019		2020	
	Past 12-month consumers	All respondents	Past 12-month consumers	All respondents	Past 12-month consumers	All respondents
Did you grow any cannabis plants in the past 12 months?	<i>n</i> = 2413	–	<i>n</i> = 5069	<i>n</i> = 15,256	<i>n</i> = 5011	<i>n</i> = 15,780
Yes % (n)	5.8% (137)	–	7.9% (351)	5.7% (736)	8.8% (406)	6.1% (808)
How many plants did you grow in the past 12 months?	<i>n</i> = 130	–	<i>n</i> = 334	<i>n</i> = 661	<i>n</i> = 385	<i>n</i> = 722
Median (SE)	3.5 (0.4)	–	3.3 (0.3)	3.1 (0.2)	3.3 (0.2)	3.1 (0.1)
Four plants or fewer % (n)	57.7% (72)	–	67.7% (230)	72.3% (487)	75.5% (283)	76.9% (561)
More than four plants % (n)	42.3% (58)	–	32.3% (104)	27.7% (174)	24.5% (102)	23.1% (161)
How much money did you spend on plants/seeds in the past 12 months?	<i>n</i> = 43	–	<i>n</i> = 158	<i>n</i> = 314	<i>n</i> = 171	<i>n</i> = 311
Median (SE)	\$95.29 (47.7)	–	\$63.68 (10.6)	\$59.91 (5.7)	\$76.10 (6.0)	\$59.03 (3.0)
Average cost per plant grown in the past 12 months (\$/plant)	<i>n</i> = 42	–	<i>n</i> = 155	<i>n</i> = 299	<i>n</i> = 166	<i>n</i> = 291
Median (SE)	\$18.08 (3.8)	–	\$14.49 (1.4)	\$14.05 (1.3)	\$15.87 (1.9)	\$15.50 (1.8)

SE = Standard Error; Home cultivation was not asked to all consumers in 2018.

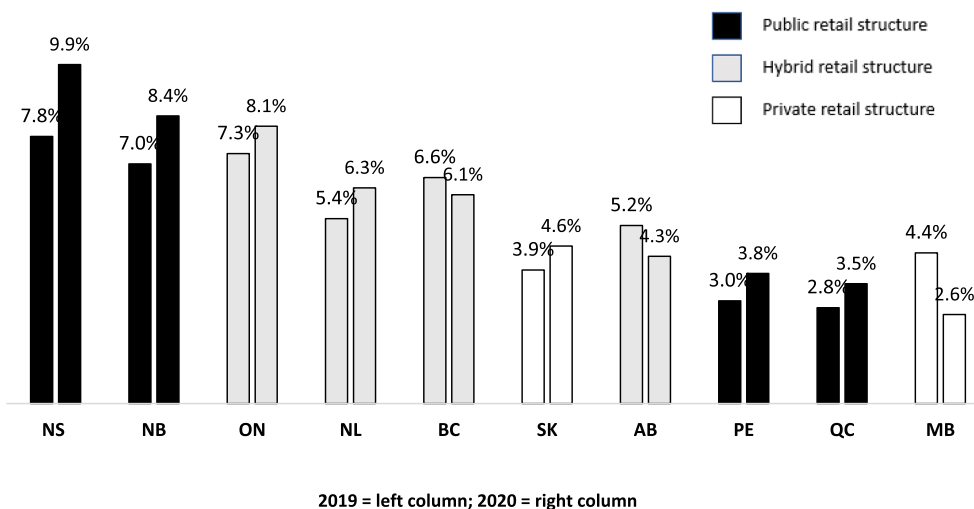


Fig. 1. Home cultivation in the past 12-months among Canadians in 2019 (left) and 2020 (right) by province (Yes %).

all secondary covariates.

4. Discussion

Home cultivation among past 12-month cannabis consumers increased to a modest extent following legalization of non-medical cannabis in Canada, from approximately 6% in 2018, to 8% and 9% in 2019 and 2020. Similar estimates of home cultivation were found in the Canadian Cannabis Survey; however, the percentage of home cultivation in 2020 was slightly higher than the current study (15.3% vs 8.8%) (Government of Canada, 2019, 2017, 2018, 2020). This is potentially due to a change of question in the Canadian Cannabis Survey from 2019 to 2020 (Government of Canada, 2019, 2020). In 2020, the Canadian Cannabis Survey asked for plants grown within respondents' home, not necessarily grown by the respondents themselves, i.e., a family member. The current study only asked about *personal* home cultivation.

The majority of growers appear to have abided to the non-medical limit of four plants after legalization. In 2020, three-quarters of consumers grew four plants or less in the past 12-months, compared to only half in 2018. Indeed, the median number of plants grown in the past 12-

months in 2020 was 3.3, similar to what was found in the 2020 Canadian Cannabis Survey (3.0) (Government of Canada, 2020). These results suggest that four plants is a realistic limit for the majority of growers, and that perhaps those that grew prior to legalization had either a higher limit of plants due to medical authorization, or no limit, as their activities were illegal. In addition, it could reflect a reduced need to grow higher quantities, given the widespread availability of legal sources. Future research should explore the reasons for growing and whether home cultivation reduces access to the illegal market.

Home cultivation rates were lower in provinces that prohibited home cultivation, namely Manitoba and Quebec. These results complement research from the U.S., where consumers in states with more restrictive cannabis policies were less likely to report growing cannabis plants (Azofeifa et al., 2021; Borodovsky & Budney, 2017). Notably, the prohibition of non-medical home cultivation in Quebec and Manitoba is being challenged. If these laws are overturned, these provinces may see an increase in home cultivation (Brown, 2021).

Ontario, Nova Scotia, New Brunswick, and British Columbia had the highest rates of home cultivation in 2019 and 2020. A potential explanation is access or the price of legal cannabis, where low access and high

Table 3
Weighted binary logistic regression analysis for correlates of home cultivation in the past 12 months among Canadians in 2019 and 2020 (n = 26,304).

	Did you grow any cannabis plants in the past 12 months?		
	Yes % (n)	AOR (95% CI)	AOR (95% CI)
Survey wave			
2019	5.7 (736)	REF	REF
2020	6.1 (808)	1.12 (0.96, 1.31)	1.12 (0.96, 1.31)
Province of residence			
ON	7.8 (470)	2.51 (1.96, 3.21)	–
NS	8.9 (147)	2.35 (1.73, 3.21)	–
NB	7.7 (122)	1.97 (1.39, 2.78)	–
BC	6.3 (259)	1.96 (1.50, 2.56)	–
NL	5.8 (70)	1.49 (0.96, 2.30)	–
AB	4.8 (191)	1.22 (0.91, 1.65)	–
PE	3.4 (13)	1.11 (0.53, 2.35)	–
SK	4.3 (58)	1.12 (0.74, 1.69)	–
MB	3.5 (44)	0.81 (0.47, 1.39)	–
QC	3.1 (170)	REF	–
Cultivation prohibited?			
Yes	3.2 (214)	–	0.48 (0.39, 0.59)
No	6.8 (1330)	–	REF
Rural/Urban status			
Urban	5.2 (993)	REF	REF
Rural	8.4 (262)	1.99 (1.61, 2.45)	1.91 (1.56, 2.34)
Cannabis use status			
Non-consumer	2.1 (355)	REF	REF
Non-daily consumer	8.7 (559)	4.19 (3.40, 5.16)	4.25 (3.45, 5.23)
Daily consumer	21.8 (630)	10.68 (8.52, 13.39)	10.73 (8.55, 13.46)
Medical authorization in past 12 months			
Yes	25.8 (294)	2.64 (2.02, 3.45)	2.60 (2.00, 3.38)
No	5.0 (1250)	REF	REF
Sex at birth			
Female	5.4 (889)	REF	REF
Male	6.4 (655)	1.17 (0.99, 1.37)	1.17 (0.99, 1.37)
Age			
16–25	4.0 (204)	0.65 (0.49, 0.88)	0.63 (0.47, 0.84)
26–35	8.4 (390)	1.08 (0.85, 1.37)	1.04 (0.82, 1.32)
36–45	6.6 (322)	1.09 (0.85, 1.39)	1.06 (0.83, 1.35)
46–55	5.2 (277)	0.87 (0.68, 1.11)	0.86 (0.68, 1.10)
56–65	5.1 (351)	REF	REF
Education			
Less than high school	5.8 (148)	REF	REF
High school	7.0 (289)	1.19 (0.88, 1.60)	1.19 (0.88, 1.60)
Some college	6.1 (701)	1.06 (0.80, 1.41)	1.05 (0.79, 1.40)
Degree or higher	4.7 (393)	1.00 (0.73, 1.38)	1.03 (0.75, 1.41)
Ethnicity/race			
Black	11.1 (83)	1.65 (1.13, 2.40)	1.82 (1.26, 2.64)
East/South East Asian	2.9 (59)	0.65 (0.44, 0.97)	0.66 (0.45, 0.98)
Indigenous	8.8 (55)	1.09 (0.71, 1.66)	0.92 (0.61, 1.39)
Latinx	8.6 (21)	0.63 (0.24, 1.64)	0.67 (0.26, 1.73)
Middle East	3.3 (10)	0.62 (0.23, 1.66)	0.67 (0.25, 1.75)
South Asian	5.2 (45)	1.00 (0.64, 1.58)	1.06 (0.67, 1.66)
White	6.0 (1159)	REF	REF
Mixed/Other	7.4 (93)	0.85 (0.62, 1.17)	1.00 (0.72, 1.40)
Income adequacy			

Table 3 (continued)

	Did you grow any cannabis plants in the past 12 months?		
	Yes % (n)	AOR (95% CI)	AOR (95% CI)
Very/Difficult	7.7 (562)	REF	REF
Neither easy nor difficult	5.2 (497)	0.86 (0.71, 1.04)	0.87 (0.72, 1.06)
Very/Easy	5.3 (452)	0.89 (0.73, 1.10)	0.91 (0.75, 1.12)
Not stated	3.8 (33)	0.75 (0.33, 1.70)	0.80 (0.34, 1.89)
Device used			
Smartphone	6.7 (748)	1.12 (0.94, 1.32)	1.09 (0.92, 1.30)
Tablet	4.7 (106)	0.95 (0.69, 1.31)	0.95 (0.69, 1.30)
Computer	5.3 (690)	REF	REF

Bold text = significant at the p < 0.05 level.

AOR = Adjusted odds ratio; CI = Confidence Interval.

prices may encourage cultivation. For example, Ontario was slower to open legal ‘brick and mortar’ stores than other provinces: the first store opened six months after legalization. Two years after legalization, in September 2020, Ontario still had only 112 stores (0.9 stores per 100,000 residents aged 15 and over). However, after the current data collection in September 2021, Ontario had 1042 stores (8.3 stores per 100,000 residents aged 15 and over) (Alcohol and Gaming Commission of Ontario, 2021; Statistics Canada, 2021). As Ontario increases their number of stores, greater accessibility and lower prices in the legal market may reduce incentive to grow your own plants; therefore, we may see further changes to home cultivation rates past the current study period. Moreover, if consumers were growing plants for sale, the greater availability of legal cannabis is likely to reduce the demand for illegal cannabis. Quebec, the province with the lowest rates of home cultivation, also had a low number of stores per 100,000 residents in 2019 and 2020; however, Quebec also reported some of the cheapest average dried flower prices across the provinces (Mahamad, Wadsworth, Rynard, Goodman, & Hammond, 2020; Martin, 2019; Wadsworth, Driezen, Goodman, & Hammond, 2020). It is possible that retail structure (i.e., private, public, hybrid) could influence home cultivation rates; however, evidence of this was not found in the current study. Future research should continue to examine the rates of home cultivation by province and retail structure over the years.

Location may determine whether Canadians grow their own cannabis plants. Canadians residing in rural locations had higher odds of home cultivation. Similarly, in a study among U.S. cannabis consumers, higher rates of home cultivation were found among those living in rural areas of the U.S (Azofeifa et al., 2021). It may suggest that Canadians residing in rural areas may have more land and space to grow, further from retail stores, or comfort to grow undetected or without disturbing neighbours. Indeed, respondents living in smaller living spaces in urban settings may be further influenced by restrictions on home cultivation in rented accommodation or shared living spaces (Government of Alberta, 2021; Nanowski, 2018).

A strength of the current study is its inclusion of both consumers and non-consumers (i.e., those who had not consumed within the past 12-months or ever). Previous research focuses on cannabis consumers, where more frequent cannabis consumers have higher rates of home cultivation than infrequent consumers, as seen in the current study (Azofeifa et al., 2021; Potter et al., 2015). However, non-consumers also grow cannabis plants either for sharing or sale, and therefore should be included in research. The Canadian Cannabis Survey included non-consumers in their 2020 study; however, the survey did not specify personal cultivation by non-consumers, i.e., non-consumers could report home cultivation in their home by others (Government of Canada, 2020). Future research should capture non-consumers in studies around home cultivation and examine the reasons for growing.

4.1. Limitations

This study is subject to limitations common to survey research. Respondents were recruited using non-probability-based sampling; therefore, the findings do not necessarily provide nationally representative estimates. The data were weighted by age group, sex, region, education and smoking status in Canada. Cannabis use estimates were generally lower than national estimates for young adults, and higher than national surveys in Canada. This is likely because the ICPS sampled individuals aged 16–65, whereas national surveys included older adults, who are known to have lower rates of cannabis use.

The 2018 survey did not ask all respondents about home cultivation, only past 12-month cannabis consumers. We were therefore unable to examine the changes between 2018 and 2019/2020 among all respondents, only past 12-month consumers. Future research should include non-consumers and cannabis consumers when surveying home cultivation practices.

A total of 15% of the sample in the regression analysis were removed due to missing values in rural/urban status. To ensure we were not introducing substantial bias into the analyses, we conducted a sensitivity analysis with rural/urban status removed and similar patterns emerged.

The survey did not clarify whether the amount spent on plants/seeds or clones corresponded with the number of plants grown, i.e., some seeds may not have been planted or completed gestation. Therefore, the 'price per plant' value may change depending on whether only 'successful' plants or incomplete plants were counted.

4.2. Conclusion

Almost one in ten Canadian cannabis consumers reported home cultivation of cannabis in 2020, with modest increases following legalization of non-medical cannabis. The uptake of home cultivation is associated with province and cultivation policies; specifically, Manitoba and Quebec, the only provinces to prohibit non-medical home cultivation, reported among the lowest rates. Although the current study reported an increase in home cultivation among past 12-month consumers after legalization, it will be important to see whether rates continue to increase, even as access to legal cannabis and the price of legal cannabis decreases. Research on what home cultivation means for public health is limited: future research should examine whether home cultivation supports or hinders the Cannabis Act's objectives. For instance, whether home cultivation reduces the use of illegal sources, or whether it increases overall consumption due to easier access in the home.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.abrep.2022.100423>.

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