Taylor & Francis
Taylor & Francis Group

The American Journal of Drug and Alcohol Abuse
Encompassing All Addictive Disorders

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/iada20

Perceived access to cannabis and ease of purchasing cannabis in retail stores in Canada immediately before and one year after legalization

Elle Wadsworth, Pete Driezen, Gary Chan, Wayne Hall & David Hammond

To cite this article: Elle Wadsworth, Pete Driezen, Gary Chan, Wayne Hall & David Hammond (2022): Perceived access to cannabis and ease of purchasing cannabis in retail stores in Canada immediately before and one year after legalization, The American Journal of Drug and Alcohol Abuse, DOI: 10.1080/00952990.2021.2003808

To link to this article: https://doi.org/10.1080/00952990.2021.2003808

THE AMERICAN JOURNAL OF DRUG AND ALCOHOL ABUSE
https://doi.org/10.1080/00952990.2021.2003808

Taylor & Francis
Taylor & Francis Group

ORIGINAL ARTICLE

Perceived access to cannabis and ease of purchasing cannabis in retail stores in Canada immediately before and one year after legalization

Elle Wadsworth[a], Pete Driezen[a,b], Gary Chan[c], Wayne Hall[c,d], and David Hammond[a]

[a]School of Public Health Sciences, University of Waterloo, Waterloo, ON, Canada; [b]Department of Psychology, University of Waterloo, Waterloo, ON, Canada; [c]National Centre for Youth Substance Use Research, University of Queensland, Brisbane, QLD, Australia; [d]National Addiction Centre, Kings College London, London, UK

ABSTRACT

Background: Canada legalized non-medical cannabis in October 2018. Little research has examined the change in perceived access to cannabis after legalization in Canada, including the perceived ease of purchasing cannabis in a legal market.

Objectives: To: 1) describe changes in perceived ease of access to cannabis before and one year after legalization; 2) examine associations between perceived ease of cannabis access and cannabis use; and 3) examine associations between perceived ease of purchasing from cannabis stores and cannabis use.

Methods: Repeat cross-sectional data come from Canadian respondents aged 16–65 (50% male) in August-October 2018 (n = 10,057) and September-October 2019 (n = 15,256). Respondents were recruited through commercial online panels. Multivariable logistic regression models examined correlates of perceived proximity to retail stores, ease of access, and ease of purchasing from retail stores.

Results: Canadians who do not consume cannabis were more likely to report "easy" access to cannabis in 2019 than in 2018 (55% vs. 42%; AOR = 1.80:1.66,1.96). All cannabis consumer groups were more likely to report living 15 minutes or less from a retail store in 2019 than 2018, but the association was strongest among non-consumers in 2019 vs 2018 (AOR = 2.01:183,2.21 vs. AOR = 1.33:1.03,1.73 for daily consumers). Non-daily and daily cannabis consumers were more likely to report it was easy to purchase from an illegal (AOR ranged 1.58–2.22) or legal (AOR ranged 1.31–1.39) store than non-consumers in 2019.

Conclusion: Most cannabis consumers and non-consumers perceived access to cannabis as 'easy' before legalization and the percentage increased one year after legalization.

ARTICLE HISTORY
Received 26 July 2021
Revised 1 November 2021
Accepted 4 November 2021

KEYWORDS
Cannabis; marijuana; perceived access; proximity; legalization

Introduction

Canada has among the highest rates of cannabis use in the world, with approximately one in five adults reporting use in the past three months (1). In 2019, approximately one in five Canadians aged 16 and over who used cannabis in the past 12-months reported daily use (2). Canada legalized non-medical cannabis in 2018, permitting adults to access legal cannabis through physical retail stores, online stores, or to grow their own at home (3).

Retail models vary across the provinces and territories, with some opting for government-run, some private, and some a combination of both (hereafter a 'hybrid' model) (3,4). Access to legal cannabis varied across the country in the first year of legalization. In September 2019, there were 508 retail stores across the 10 provinces, 300 of these were in Alberta (a province with a hybrid retail model) (Table S1). Ontario initially planned a government-run retail model but after a change in provincial government, switched to a hybrid model, and only opened its first stores in April 2019. Ontarians only initially had access to the government-run online store, which suffered from slow deliveries and stock shortages in the first few months (5,6). Access to cannabis stores in Canada in the first six months of legalization was higher in provinces with a private or hybrid retail rather than a government-run model (7).

Canada had a well-established illegal cannabis market prior to legalization. In 2017, Statistics Canada estimated that Canadians spent $5 billion CAD On illegal cannabis (8). Prior to legalization, Canadians could access illegal cannabis though physical dispensaries, dealers, and online stores (9). In the first year after legalization, many consumers still obtained cannabis from illegal sources (2,10).

Access may influence whether cannabis consumers use legal or illegal markets. In the 2018 and 2019 National Cannabis Surveys, approximately one third of Canadians who consumed cannabis in the past three months stated

CONTACT Elle Wadsworth ewadsworth@uwaterloo.ca School of Public Health Sciences, University of Waterloo, 200 University Ave W, Waterloo, ON, Canada N2L 3G1

Supplemental data for this article can be accessed on the publisher's website.

that accessibility and location were the most important factors in choosing a cannabis source (1,11). However, increasing access to cannabis for adults must also avoid increasing access to youth (12). In the 2018–2019 Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS), 40% reported cannabis was easy to obtain, but when asked if it had been easier or harder since legalization, more students reported it had been "easier" or "neither easier nor harder," than "harder" to obtain cannabis (13). Canada must balance increasing access to legal cannabis to reduce the illegal market without encouraging use among underage youth.

Most research on changes in access to cannabis before and after legalization of recreational and/or medical cannabis has been conducted in the United States. In Washington State's retail market, greater access to cannabis retail stores was associated with increased cannabis use after legalization (14). Similarly, research in California found a positive association between the physical availability of medical cannabis stores and frequency of cannabis use (15). In a study among young adults in Los Angeles County before and after the opening of licensed retail stores, greater retail density of both licensed and unlicensed stores was associated with heavier and problematic cannabis use (16). Research among US adolescents has reported either a relationship between access to cannabis, legalization, and cannabis use (17,18), or no such relationship (18–22).

The current study examined changes in access to cannabis immediately prior and one year after legalization and in the perceived ease of purchasing cannabis one year after legalization. Access to cannabis was represented in two ways: 1) perceived proximity to cannabis retail stores, either illegal or legal; and 2) overall access to cannabis, either illegal or legal.

Our specific aims were to 1) describe the change over time among Canadians' perceived proximity to cannabis stores and access to cannabis from 2018 to 2019; 2) examine the associations between perceived proximity to cannabis stores, overall perceived ease of access to cannabis and cannabis use over time; and 3) examine associations between perceived ease of purchasing cannabis from illegal or legal stores and cannabis use in 2019. We hypothesized that the percentage of respondents living close to a cannabis retail store would increase following legalization, either illegal or legal, while overall access to cannabis would remain stable among cannabis consumers. We also hypothesized that perceived ease of purchasing would be greater from legal than illegal stores. Post-hoc analyses examined the relationship between the legal age to purchase cannabis and perceived ease of purchasing from illegal or legal stores.

Methods

Study design and sample

We used repeat cross-sectional data from the 2018 and 2019 waves of the International Cannabis Policy Study (ICPS) conducted in Canada and the United States (US) (23). Data were collected via self-completed web-based surveys conducted in August-October 2018 and September-October 2019 from respondents aged 16–65. A non-probability sample of respondents was recruited through the Nielsen Consumer Insights Global Panel and their partners' panels. The Nielsen panels are recruited using a variety of probability and non-probability sampling methods. For the ICPS surveys, Nielsen draws stratified random samples from the online panels, with quotas based on age and state/province of residence. Nielsen e-mails 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 underrepresented in surveys, including disadvantaged subgroups (24).

Surveys were conducted in English in the US and English or French in Canada. Median survey time was 20 minutes in 2018 and 25 minutes in 2019. 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 (25). As an additional data integrity check, respondents are asked to identify the current month from a list toward the end of the survey to verify survey engagement.

The current study reports data from the Canadian sample only. In 2018, 1,428,857 invitations were sent, of which 17,157 Canadian respondents accessed the survey link, and 10,646 completed the entire survey for a cooperation rate of 62.1% (26–28). In 2019, 2,433,278 invitations were sent, of which 24,607 Canadian respondents accessed the survey link, and 17,513 completed the entire survey for a cooperation rate of 71.2% (26–28).

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 Technical Reports (27,28).

Measures

The full ICPS surveys are available online (www.cannabisproject.ca/methods). All questions included 'Don't know' and 'Refuse to answer' options. In all measures except 'perceived income adequacy,' "Refuse to answer" options were treated as missing.

Socio-demographic measures were sex at birth, age, ethnicity/race, highest education level, perceived income adequacy, and province of residence. Age was categorized into: "Under minimum legal age" and "Minimum legal age and over." Minimum legal age was taken from provincial laws in Canada (October 2018 onwards): 18 years in Alberta and Quebec, and 19 years in all other provinces. For all socio-demographic measures except 'perceived income adequacy,' "Don't know" options were treated as missing. See Table 1 for full coding of response options.

Cannabis use status: Cannabis use status was classified into "Never user," "Used more than 12 months ago," "Past 12-month user," "Monthly user," "Weekly user," "Daily/almost daily user." Responses were further categorized into "Non-consumer" (Never/Used more than 12 months ago), "Non-daily consumer" (Past 12-month/Monthly/Weekly), and "Daily consumer."

Perceived proximity to nearest retail store (2018, 2019): Participants were asked "How long would it take you to get to the nearest store that sells cannabis using your usual mode of transportation?" Responses began at "Less than five minutes" and increased in five-minute increments up to one hour and ended with "More than an hour" and "I don't know any stores near to where I live." This measure included both illegal and legal retail stores. Responses were categorized to "Under 5 mins," "5–15 mins," "Over 15 mins" and "I don't know any stores near to where I live." These categories were chosen to approximately match the time taken to travel 3 km and 10 km by car at 40–60 km per hour to mimic the distance chosen by Statistics Canada (29). For regression analyses, responses were categorized into: "15 mins or less" vs. "Other."

Overall access to cannabis (2018, 2019): Participants were asked "Overall, how easy or difficult would it be for you to get marijuana?" with response options "Very easy," "Fairly easy," "Neither easy nor difficult," "Fairly difficult," "Very difficult," and "Don't know." Responses were categorized to "Easy," "Neither easy nor difficult," "Difficult," "Don't know." For regression analyses, responses were categorized into: "Easy" vs. "Other." This measure includes access to both illegal and legal cannabis.

Perceived ease of purchasing cannabis from illegal and legal stores (2019 only): Participants were asked "How easy or difficult would it be for you to buy marijuana from a ____ store or dispensary in the city or town where you live?" for illegal and legal stores separately with response options "Very easy," "Fairly easy," "Neither easy nor difficult," "Fairly difficult," "Very difficult," and "Don't know." Responses were categorized to "Easy," "Neither easy nor difficult," "Difficult," "Don't know." For regression analyses, both responses were categorized into: "Easy" vs. "Other." This question was only asked in 2019.

Table 1. Sample characteristics of Canadians in 2018 and 2019 (N = 25,313).

	2018 (n = 10,057) Weighted % (unweighted n)	2019 (n = 15,256) Weighted % (unweighted n)
Age[a]		
Under Minimum Legal Age (MLA)	12.5 (660)	8.8 (734)
MLA and older	87.5 (9397)	92.2 (14522)
Cannabis use status		
Non-consumer[b]	72.5 (7644)	64.7 (10187)
Non-daily consumer[c]	18.6 (1664)	24.0 (3576)
Daily consumer[d]	8.9 (749)	11.3 (1493)
Sex at birth		
Female	49.8 (5845)	49.7 (9373)
Male	50.2 (4212)	50.3 (5883)
Ethnicity/Race		
White	77.3 (8195)	73.2 (11617)
Mixed/Other	22.7 (1862)	26.8 (3639)
Highest level of Education		
Less than high school	15.6 (873)	15.6 (1241)
High school diploma	26.8 (1548)	26.8 (2516)
Some college or technical vocation	32.7 (4268)	32.7 (6382)
Bachelor's degree or higher	25.0 (3309)	24.9 (4968)
Income adequacy		
Very difficult/Difficult	28.1 (2806)	31.8 (4714)
Neither easy nor difficult	35.9 (3593)	34.9 (5333)
Very easy/Easy	32.5 (3380)	29.2 (4701)
Not specified	3.5 (278)	4.1 (508)
Province of residence		
British Columbia	13.2 (947)	13.7 (2211)
Alberta	12.0 (931)	11.9 (2200)
Saskatchewan	3.1 (858)	3.0 (843)
Manitoba	3.6 (923)	3.6 (877)
Ontario	39.0 (2713)	39.2 (3315)
Quebec	22.6 (984)	22.2 (3612)
New Brunswick	2.0 (871)	2.0 (697)
Nova Scotia	2.6 (913)	2.6 (855)
Prince Edward Island	0.4 (212)	0.4 (145)
Newfoundland & Labrador	1.4 (705)	1.4 (501)

Difference in unweighted sample sizes are due to missing data in Education (n_{2018} = 59, n_{2019} = 149).
[a]Minimum Legal Age is taken from legal market (October 2018 onwards), and is 18 years in Alberta and Quebec, and 19 years in all other provinces.
[b]Used more than 12-months ago/Never consumers;
[c]Less than monthly/Monthly/Weekly consumers;
[d]Includes 'almost daily consumers'

Statistical analysis

Respondents were removed for reasons such as poor data quality and duplicate entries (n = 2,846). For example, respondents were removed if they incorrectly answered the data quality check question: "What is the current month?," and duplicate entries were those where over 20 sociodemographic variables (including postal code) matched another entry. The final Canadian cross-sectional samples comprised 10,057 and 15,256 respondents in 2018 and 2019, respectively. See Technical Reports for more detail on exclusions (27,28). Missing data were assumed to be missing at random and removed using case-wise deletion for four variables used in regression models: perceived proximity to nearest retail store (n_{2018} = 44, n_{2019} = 86 [0.5% of regression sample]); overall perceived ease of access (n_{2018} = 80, n_{2019} = 35 [0.5%]); perceived ease of purchasing cannabis from an illegal (n_{2019} = 80 [0.5%]) or legal store (n_{2019} = 70 [0.5%]); and highest level of education (n_{2018} = 59, n_{2019} = 149 [0.8%]).

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, respondents were classified into age-by-sex-by-province, education, and age-by-smoking 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 both years in Canada. Estimates are weighted unless otherwise specified (27,28).

Descriptive statistics estimated perceived proximity to the nearest retail store and perceived access in 2018 and 2019 by cannabis use status. For each cannabis consumer group, reported time to the nearest store and perceived ease of access was compared between 2018 and 2019. Second, multivariable binary logistic regression models examined correlates of perceived ease of access to cannabis in 2018 and 2019, represented as: 1) perceived proximity to nearest retail store (15 mins or less vs. Other); and 2) overall perceived ease of access (Easy vs. Other), and a two-way interaction between survey wave and cannabis use status. Third, multivariable logistic regression models examined correlates of perceived ease of purchasing from a retail store in 2019 for 1) illegal; and 2) legal retail stores (both Easy vs. Other). As a sensitivity analysis, all four models were refit as multinomial regression models, where perceived proximity was categorized to "15 mins or less," "Over 15 mins," "I don't know any stores" and all other models were categorized to "Easy" "Neither/Don't know," "Difficult" to ensure comparable patterns with the binary analysis. Post-hoc analyses examined the association between the legal age to purchase cannabis and perceived ease of purchasing from a retail store with bivariate logistic regression models.

All models adjusted for age, sex at birth, education, ethnicity/race, income adequacy, and province of residence. Adjusted odds ratios (AORs) were reported with 95% confidence intervals (95% CI). Statistical tests controlled for multiple comparisons using the Benjamini-Hochberg procedure to reduce the false discovery rate (30). Descriptive statistics were estimated using SAS-callable SUDAAN (SAS version 9.4, SAS Institute; SUDAAN version 11.0.3, Research Triangle Institute) while multiple comparisons were tested using SAS. All other analyses were conducted using survey procedures in SAS (SAS version 9.4, SAS Institute Inc., Cary, NC, USA).

Results

Table 1 displays the unweighted and weighted sample characteristics of Canadians in 2018 and 2019. In both years, approximately half the respondents were male, three quarters were White, and between a quarter and a third of respondents were cannabis consumers.

Perceived proximity to nearest retail store in 2018 and 2019

Table 2 displays the perceived proximity to the nearest retail store among non-consumers, non-daily consumers, and daily consumers in 2018 and 2019. The percentage of non-consumers who reported living less than 5 minutes from a retail store increased from 2018 to 2019 ($p < .001$). The percentage of non-consumers, non-daily, and daily consumers who reported living 5 to 15 minutes and over 15 minutes from a retail store increased from 2018 to 2019 (all $p < .05$). The percentage of non-consumers, non-daily, and daily consumers who were not aware of their nearest retail store decreased from 2018 to 2019 (all $p < .001$).

A logistic regression model examined correlates of the perceived proximity to nearest retail stores (Table 3). An interaction test between cannabis use status and survey year was significant ($F_{2,24990}$ = 4.82, $p = .008$). After adjusting for covariates, non-consumers (AOR = 2.01, 95%CI: 1.83,2.21) and non-daily consumers (AOR = 1.73, 95%CI: 1.47,2.04) reported a greater increase in the percentage living 15 minutes or less to their nearest retail store than daily consumers from 2018 to 2019 (AOR = 1.33, 95%CI: 1.03,1.73).

Table 2. Trend across 2018 and 2019 among non-consumers, non-daily consumers, and daily consumers in perceived proximity to nearest retail cannabis store and overall access to cannabis (N = 25,183).

	Non-consumers[a]				Non-daily consumers[b]				Daily consumers[c]			
	2018 (n = 7,613) % (n)	2019 (n = 10,142) % (n)	Difference %	p-value	2018 (n = 1,653) % (n)	2019 (n = 3,553) % (n)	Difference %	p-value	2018 (n = 747) % (n)	2019 (n = 1,493) % (n)	Difference %	p-value
Perceived proximity to nearest retail store[d]												
Under 5 minutes	4.3 (369)	6.2 (805)	+1.9	<0.001	6.2 (110)	7.4 (348)	+1.2	0.221	8.4 (60)	9.0 (171)	+0.6	0.726
5–15 minutes	17.4 (1565)	28.3 (3341)	+10.9	<0.001	26.3 (490)	35.4 (1437)	+9.1	<0.001	27.1 (217)	32.9 (539)	+5.8	0.035
Over 15 minutes	24.2 (1903)	34.4 (3405)	+10.2	<0.001	32.7 (509)	44.4 (1416)	+11.7	<0.001	31.7 (244)	48.7 (656)	+17	<0.001
I don't know any stores near to where I live	54.1 (3776)	31.1 (2591)	−23.0	<0.001	34.8 (544)	12.7 (352)	−22.1	<0.001	32.8 (226)	9.5 (109)	−23.3	<0.001
Overall ease of access to cannabis[e]												
Easy	42.3 (3322)	55.4 (6033)	+13.1	<0.001	75.8 (1262)	76.2 (2766)	+0.4	0.919	87.5 (653)	83.9 (1270)	−3.6	0.196
Neither easy nor difficult	14.3 (933)	13.2 (1187)	−1.1	0.196	15.4 (247)	14.1 (469)	−1.3	0.498	8.4 (55)	9.0 (117)	+0.6	0.870
Difficult	13.3 (923)	7.3 (626)	−6.0	<0.001	5.5 (86)	5.0 (156)	−0.5	0.746	3.9 (30)	4.0 (55)	+0.1	0.943
Don't know	30.2 (2447)	24.2 (2298)	−6.0	<0.001	3.2 (60)	4.8 (161)	+1.6	0.068	0.3 (4)	3.1 (38)	+2.8	<0.001

n = unweighted sample size in each category. Difference in unweighted sample sizes are due to missing data in 'Perceived proximity to nearest store' (n_{2018} = 44, n_{2019} = 86); 'Overall perceived ease of access to cannabis' (n_{2018} = 80, n_{2019} = 35).
Difference = estimated percentage in 2019 minus estimated percentage in 2018. Multiple comparisons adjusted for false discovery rate.
[a]Used more than 12-months ago/Never consumers;
[b]Less than monthly/Monthly/Weekly consumers;
[c]Includes 'almost daily consumers';
[d]Respondents could answer for illegal or legal retail store;
[e]Respondents could answer for illegal or legal cannabis.

Table 3. Weighted multivariable logistic regression analysis for perceived proximity to nearest cannabis store and overall perceived ease of access to cannabis in 2018 and 2019.

	Perceived proximity to nearest cannabis store (n = 24,992)[a]		Overall perceived ease of access to cannabis (n = 25,008)[b]	
	% 15 mins or less (n)	15 mins or less (vs. Other) AOR (95% CI)	% Easy (n)	Easy (vs. Other) AOR (95% CI)
Survey year x Cannabis use status				
2019 (vs. 2018) x Non-consumer[c]	-	**2.01 (1.83, 2.21)**	-	**1.80 (1.66, 1.96)**
2019 (vs. 2018) x Non-daily consumer[d]	-	**1.73 (1.47, 2.04)**	-	1.10 (0.91, 1.33)
2019 (vs. 2018) x Daily consumer[e]	-	**1.33 (1.03, 1.73)**	-	0.78 (0.54, 1.13)
Age				
Under Minimum Legal Age (MLA)[f]	25.8 (387)	0.98 (0.83, 1.15)	58.3 (815)	**1.27 (1.08, 1.49)**
MLA and older	33.2 (9065)	REF	59.3 (14491)	REF
Sex at birth				
Female	31.7 (5714)	REF	57.7 (9122)	REF
Male	33.1 (3738)	1.04 (0.97, 1.12)	60.6 (6184)	**1.09 (1.01, 1.17)**
Ethnicity/Race (vs. White)				
White	33.0 (7631)	REF	62.7 (12625)	REF
Mixed/Other	30.7 (1821)	**0.86 (0.78, 0.93)**	48.7 (2681)	**0.56 (0.52, 0.62)**
Highest level of Education				
Less than high school	28.8 (661)	REF	60.5 (1286)	REF
High school diploma	30.2 (1380)	0.99 (0.85, 1.15)	59.3 (2464)	0.97 (0.84, 1.13)
Some college or technical vocation	34.8 (4091)	**1.23 (1.07, 1.42)**	63.1 (6843)	**1.17 (1.01, 1.35)**
Bachelor's degree or higher	34.0 (3272)	**1.27 (1.10, 1.48)**	54.2 (4660)	0.94 (0.81, 1.08)
Income adequacy				
Very difficult/Difficult	33.2 (2877)	**REF**	62.6 (4842)	REF
Neither easy nor difficult	30.5 (3201)	0.94 (0.86, 1.02)	55.7 (5132)	**0.82 (0.75, 0.90)**
Very easy/Easy	34.9 (3185)	**1.15 (1.05, 1.26)**	62.1 (5060)	**1.11 (1.01, 1.21)**
Not specified	22.9 (189)	**0.68 (0.53, 0.86)**	38.9 (272)	**0.51 (0.41, 0.63)**
Province of residence				
Ontario	23.7 (1434)	REF	56.3 (3289)	REF
Quebec	22.4 (1174)	0.95 (0.85, 1.05)	53.3 (2520)	**0.86 (0.78, 0.95)**
Manitoba	37.1 (605)	**1.98 (1.71, 2.29)**	60.0 (1021)	**1.21 (1.05, 1.40)**
Newfoundland & Labrador	47.2 (503)	**2.94 (2.49, 3.48)**	69.8 (794)	**1.80 (1.52, 2.15)**
Saskatchewan	46.7 (754)	**2.94 (2.56, 3.39)**	64.0 (1002)	**1.39 (1.20, 1.60)**
Alberta	47.3 (1605)	**2.99 (2.68, 3.33)**	64.5 (2054)	**1.42 (1.27, 1.59)**
British Columbia	46.9 (1489)	**2.64 (2.63, 3.28)**	65.3 (2066)	**1.49 (1.33, 1.66)**
Nova Scotia	51.0 (862)	**3.44 (2.98, 3.98)**	70.9 (1218)	**1.76 (1.51, 2.06)**
Prince Edward Island	50.9 (157)	**3.47 (2.59, 4.64)**	72.9 (247)	**1.93 (1.38, 2.69)**
New Brunswick	58.5 (869)	**4.72 (4.07, 5.48)**	74.4 (1095)	**2.09 (1.78, 2.46)**

Omnibus tests for the interaction between survey year and cannabis use status were significant (perceived proximity to nearest cannabis store: $p = 0.008$; Overall perceived access to cannabis: $p < 0.001$). Main effects of cannabis use status and survey year were included in models but not shown in Table 3.

Difference in unweighted sample sizes are due to missing data in 'Perceived proximity to nearest store' ($n_{2018} = 44$, $n_{2019} = 86$); 'Overall perceived ease of access to cannabis' ($n_{2018} = 80$, $n_{2019} = 35$); and Education ($n_{2018} = 59$, $n_{2019} = 149$).

Weighted %, unweighted n.

[a]Respondents could answer for illegal or legal retail stores;

[b]Respondents could answer for illegal or legal cannabis;

[c]Used more than 12-months ago/Never consumers;

[d]Less than monthly/Monthly/Weekly consumers;

[e]Includes 'almost daily consumers';

[f]Minimum Legal Age is taken from provincial laws in Canada (October 2018 onwards): 18 years in Alberta and Quebec, and 19 years in all other provinces.

As a sensitivity analysis, the model was refitted as a multinomial logistic regression model and similar patterns emerged (Table S2).

Perceived overall access to cannabis in 2018 and 2019

As displayed in Table 2, the percentage of non-consumers who reported "easy" overall access to cannabis increased from 2018 to 2019 ($p < .001$), whereas the percentage of non-consumers who reported "difficult" overall access to cannabis ($p < .001$) or didn't know ($p < .001$) decreased from 2018 to 2019 (Table 2). There were no significant changes in the percentage of non-daily and daily cannabis consumers who reported overall access to cannabis was easy, neither difficult nor easy, or difficult from 2018 to 2019.

A logistic regression model examined correlates of the overall perceived ease of access to cannabis (Table 3). An interaction test between cannabis use status and survey year was significant ($F_{2,25008} = 18.9$, $p < .001$). After adjusting for covariates, non-consumers reported an increase in "easy" access from 2018 to 2019 (AOR = 1.80, 95%CI: 1.66,1.96), with no significant changes among non-daily or daily consumers.

As a sensitivity analysis, the model was refitted as a multinomial logistic regression model and similar patterns emerged (Table S3).

Perceived ease of purchasing cannabis from illegal stores in 2019

In 2019, 26.0% of Canadians reported that it was easy to purchase cannabis from an *illegal* retail store. A total of 21.7% of non-consumers, 31.2% of non-daily consumers, and 40.3% of daily consumers reported that it was easy to purchase cannabis from an *illegal* retail store in 2019 (Table 4). Similar percentages of Canadians under and over their provincial minimum legal age (25.5% and 26.1%) reported that it was easy to purchase cannabis from an *illegal* retail store in 2019.

In a logistic regression analysis of correlates of perceived ease of purchasing cannabis from an *illegal* retail store in 2019, non-daily (AOR = 1.58, 95%CI: 1.42,1.76) and daily (AOR = 2.22, 95%CI: 1.91,2.58) cannabis consumers were more likely to report it was easy to purchase from an *illegal* retail store than non-consumers (Table 4). There was no association between age and perceived ease of purchasing cannabis from an *illegal* store in the bivariate (Table S4) and multivariable regression models.

As a sensitivity analysis, the model was refitted as a multinomial logistic regression model and similar patterns emerged (Table S5).

Perceived ease of purchasing cannabis from legal stores in 2019

In 2019, 51.4% of Canadians reported that it was easy to purchase cannabis from a legal retail store. A total of 48.5% of non-consumers, 57.2% of non-daily consumers, and 56.1% of daily consumers reported that it was easy to purchase cannabis from a *legal* retail store in 2019 (Table 4). A total of 23.8% of Canadians under the provincial minimum legal age and 54.1% of those over the legal age reported that it was easy to purchase from a *legal* retail store in 2019.

After adjusting for covariates, non-daily (AOR = 1.39, 95%CI: 1.26,1.54) and daily (AOR = 1.31, 95%CI: 1.13,1.52) cannabis consumers were more likely to report that it was easy to purchase from a *legal* store than non-consumers (Table 4). Canadians under minimum legal age in their province were less likely to report it was easy to purchase from a *legal* store than Canadians of legal age in the bivariate (Table S4) and multivariable regression models.

As a sensitivity analysis, the model was refitted as a multinomial logistic regression model and similar patterns emerged (Table S6).

Discussion

Perceived access increased after cannabis legalization with the extent of the increase differing between cannabis consumer groups. It increased among non-consumers while non-daily and daily consumers reported little change in perceived ease of access, suggesting that cannabis was readily available to consumers before legalization. This is consistent with previous research demonstrating widespread availability of cannabis from illegal sources and licensed medical producers in Canada (8,31,32).

In the current study, a greater percentage of non-daily and daily cannabis consumers reported that it was easy to access cannabis than non-consumers. These results are similar to a study in Washington State, which found an association between increased cannabis use and greater access to retail stores (14). The association between cannabis use status and cannabis access may be bidirectional: consumers with easier access consume cannabis more frequently, and those who consume cannabis find it easier to access. Prior research in Los Angeles County demonstrated that a higher density of licensed and unlicensed retail stores was associated with more frequent and heavier use (16).

Convenience and proximity to sources of cannabis are important factors in the perceived accessibility of cannabis. Cannabis consumers (non-daily and daily)

Table 4. Weighted multivariable logistic regression analysis for perceived ease of purchasing cannabis from an illegal retail store, and perceived ease of purchasing cannabis from a legal retail store in 2019.

	Perceived ease of purchasing cannabis from an ILLEGAL retail store in 2019 (n = 15,041)		Perceived ease of purchasing cannabis from a LEGAL retail store in 2019 (n = 15,054)	
	% Easy (n)	Easy (vs. Other) AOR (95% CI)	% Easy (n)	Easy (vs. Other) AOR (95% CI)
Cannabis use status				
Non-consumer[a]	21.7 (5589)	REF	48.5 (2105)	REF
Non-daily consumer[b]	31.2 (2274)	**1.58 (1.42, 1.76)**	57.2 (1048)	**1.39 (1.26, 1.54)**
Daily consumer[c]	40.3 (917)	**2.22 (1.91, 2.58)**	56.1 (572)	**1.31 (1.13, 1.52)**
Age				
Under Minimum Legal Age (MLA)[d]	25.5 (185)	0.96 (0.77, 1.20)	23.8 (174)	**0.39 (0.31, 0.49)**
MLA and older	26.1 (3540)	REF	54.1 (8606)	REF
Sex at birth				
Female	22.4 (2084)	REF	51.8 (5444)	REF
Male	29.6 (1641)	**1.44 (1.31, 1.58)**	51.0 (3336)	1.00 (0.92, 1.09)
Ethnicity/Race (vs. White)				
White	25.9 (2828)	REF	53.7 (7019)	REF
Mixed/Other	26.3 (897)	1.10 (0.98, 1.23)	45.1 (1761)	**0.79 (0.72, 0.88)**
Highest level of Education				
Less than high school	28.5 (339)	REF	36.9 (480)	REF
High school diploma	28.4 (677)	0.99 (0.82, 1.19)	50.2 (1357)	**1.34 (1.12, 1.60)**
Some college or technical vocation	25.8 (1606)	**0.86 (0.72, 1.02)**	57.1 (3910)	**1.66 (1.40, 1.96)**
Bachelor's degree or higher	22.8 (1082)	**0.75 (0.62, 0.90)**	55.6 (2998)	**1.64 (1.38, 1.95)**
Income adequacy				
Very difficult/Difficult	29.7 (1330)	REF	53.5 (2777)	REF
Neither easy nor difficult	23.4 (1173)	**0.75 (0.67, 0.84)**	47.9 (2914)	**0.84 (0.76, 0.93)**
Very easy/Easy	26.7 (1158)	0.91 (0.81, 1.03)	56.7 (2945)	**1.20 (1.08, 1.34)**
Not specified	15.3 (64)	**0.43 (0.30, 0.63)**	26.1 (144)	**0.44 (0.33, 0.59)**
Province of residence				
Ontario	25.8 (804)	**REF**	42.9 (1462)	**REF**
Prince Edward Island	21.5 (31)	0.81 (0.50, 1.34)	77.1 (122)	**4.81 (2.83, 8.16)**
Manitoba	23.8 (180)	0.88 (0.70, 1.12)	58.7 (555)	**1.93 (1.60, 2.34)**
Alberta	24.1 (467)	0.88 (0.75, 1.02)	67.6 (1530)	**2.79 (2.44, 3.19)**
Quebec	23.1 (774)	0.91 (0.80, 1.04)	48.6 (1857)	**1.29 (1.15, 1.45)**
Saskatchewan	25.0 (192)	0.94 (0.76, 1.17)	63.7 (571)	**2.36 (1.95, 2.87)**
Newfoundland & Labrador	25.5 (125)	1.04 (0.80, 1.34)	63.9 (335)	**2.25 (1.77, 2.85)**
Nova Scotia	31.6 (250)	**1.30 (1.06, 1.60)**	65.2 (602)	**2.49 (2.04, 3.02)**
British Columbia	32.1 (681)	**1.36 (1.19, 1.57)**	53.9 (1220)	**1.55 (1.37, 1.76)**
New Brunswick	33.2 (220)	**1.38 (1.10, 1.73)**	72.8 (526)	**3.41 (2.73, 4.25)**

Weighted % and unweighted n. Difference in unweighted sample sizes are due to missing data in 'Perceived ease of purchasing cannabis from an illegal retail store (n_{2019} = 80); 'Perceived ease of purchasing cannabis from a legal retail store (n_{2019} = 70); and Education (n_{2018} = 59, n_{2019} = 149).

[a]Used more than 12-months ago/Never consumers;

[b]Less than monthly/Monthly/Weekly consumers;

[c]Includes 'almost daily consumers'

[d]Minimum Legal Age is taken from provincial laws in Canada (October 2018 onwards): 18 years in Alberta and Quebec, and 19 years in all other provinces.

and non-consumers were more likely to report living 15 minutes or less from a retail store in 2019 than in 2018. This is probably due to legalization, because only illegal retail stores were available in 2018 (7,8). In an analysis of Canada's retail cannabis market, the average distance between Canadian households and legal retail stores declined from 66 km to 34 km between March and July 2019 (29). Statistics Canada measured proximity using distance between retail stores and households, whereas the current study measured perceived proximity, which takes account of travel time and awareness of retail stores. The percentage of respondents who were not aware of their nearest retail store decreased in 2019. Greater awareness of cannabis stores is consistent with data showing an increase in the number of legal retail stores in Canada (7,29).

It should be easier to access cannabis in a legal market than an illegal market. Non-daily and daily cannabis consumers were more likely to report it was easy to purchase cannabis from an illegal or legal retail store than non-consumers in 2019, one year after legalization, but the association was stronger for purchasing from an illegal store. All Canadians may be aware of legal cannabis stores in their local area due to media coverage or increased visibility. By contrast, cannabis consumers who purchased from illegal stores were more aware of less conspicuous illegal stores than non-consumers. There were many physical illegal stores pre-legalization in 2018 but these were concentrated in urban areas and not as visible to non-consumers as legal cannabis stores after legalization (8). In Ontario, the City of Toronto closed some illegal stores after legalization taking them out of the public eye (33). Future research should examine changes in the perceived ease of purchasing cannabis from an illegal store as the legal retail market becomes more established in Canada.

From a public health policy perspective, cannabis legalization ideally should increase access to legal cannabis for adults without increasing access or use among minors. One of the main objectives of legalization in Canada is to protect youth by restricting access (3). Over half of Canadians under the minimum legal age reported "easy" access to cannabis. This is slightly lower than estimates pre-legalization in the 2014/2015 CSTADS among Grade 11/12 students (34). In the 2018–19 CSTADS, more students reported that it was easier to access cannabis after legalization than reported it was more difficult (13). However, the extent to which youth find access "easy" may vary across cannabis sources. In the current study, Canadian minors were less likely to report that it was easy to purchase from a legal store than Canadians of legal age and they were more likely to report it was more difficult to purchase from a legal than an illegal store. This speaks to the effectiveness of regulations for legal retail outlets and the need to enforce compliance and remove illegal stores. Future research should examine perceived access to cannabis and perceived ease of purchasing cannabis among youth in the years following legalization.

Limitations

This study is subject to limitations common to survey research. Respondents were recruited using non-probability-based sampling so estimates may not be nationally representative. Indeed, the increase in cannabis consumers from 2018 to 2019 appears to be greater than the increase from national estimates (35). Cannabis use estimates were within the range of national estimates for young adults but higher in the full ICPS sample than national surveys in Canada because the ICPS sampled individuals aged 16–65, whereas the national surveys also included older adults, who have lower rates of cannabis use.

Perceptions of cannabis access or ease of purchasing is a qualitative and subjective question; therefore, notions of what constitutes as "easy" or "difficult" may change over time and with legalization, i.e., what respondents classify as "easy" before legalization may be different from what they classify as "easy" after legalization. Therefore, changes in "easy" access may be greater or smaller than reported.

The measure 'perceived proximity to a retail store' did not specify whether perceived proximity was to a legal or illegal store. More objective measures of proximity include Euclidean or street distances to a respondent's nearest retail store. Because the legal retail market is nascent, we used perceived proximity to capture both awareness of and perceived ease of access to a cannabis store that depends on mode of transport. The current study did not assess usual mode of transport; thus, perceived proximity will differ between respondents who walk, drive, or use public transit.

Age was categorized to under minimum legal age and of legal age for 2018 and 2019 data. There was no minimum legal age in 2018 before legalization so we used the same age in both years.

The current study only covered two years of repeat cross-sectional data. It is possible that the increases in overall perceived access to cannabis may have occurred in the absence of legalization. Moreover, because this study used repeat cross-sectional data, causation cannot be determined. Future research should examine perceived ease of purchasing cannabis using longitudinal data.

Finally, this study did not assess specific types of cannabis products. In the first year of legalization, not all cannabis products were available in the legal market. Perceived ease of access and purchasing may differ according to the cannabis product. However, dried flower was available from October 2018 and this was the most commonly used product by Canadians (2,36).

Conclusions

The current study provides one of the first examinations of changes in perceived access to cannabis and purchasing in cannabis stores immediately before and one year after legalization in Canada. Ease of access, represented as perceived overall access and perceived proximity to retail stores, increased from 2018 to 2019. Cannabis consumers (non-daily and daily) found it easier to purchase from illegal or legal stores than non-consumers. Canada is still within the initial years of legalization and legal cannabis may become more accessible as the market stabilizes. Future research is needed on whether perceived ease of purchasing cannabis from legal or illegal retail stores influences purchasing behaviors.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

Funding for this study was provided by a Canadian Institutes of Health Research Project Bridge Grant (PJT-153342) and a Canadian Institutes of Health Research Project Grant. Additional support was provided by a Public Health Agency of Canada-Canadian Institutes of Health Research Chair in Applied Public Health (DH) and a Vanier Canada Graduate Scholarship (EW). The funders had no role in study design, collection, analysis or interpretation of the data, report writing, or decision to submit the report for publication.

ORCID

Elle Wadsworth http://orcid.org/0000-0003-0797-8493
Wayne Hall http://orcid.org/0000-0003-1984-0096
David Hammond http://orcid.org/0000-0001-8197-6010

References

1. Statistics Canada. National Cannabis Survey, second quarter 2019. 2019. Available at: https://www150.statcan.gc.ca/n1/daily-quotidien/190815/dq190815a-eng.htm [last accessed 19 July 2021].
2. Government of Canada. Canadian Cannabis Survey 2019 – summary. 2019. Available at: https://www.canada.ca/en/health-canada/services/publications/drugs-health-products/canadian-cannabis-survey-2019-summary.html [last accessed 20 July 2021].
3. Government of Canada. Justice laws website: cannabis act (S.C. 2018, c.16) 2018.
4. Canadian Centre on Substance Use and Addiction. Policy and Regulations (Cannabis). 2020 Available from: https://www.ccsa.ca/policy-and-regulations-cannabis [last accessed 19 July 2021].
5. Cheung A. Ontario Cannabis Store lit up with complaints about slow delivery, wrong shipments. CBC News. 2018 Oct 23, 2018.
6. Gillies R, Linderman T. Supply shortages plague Canada's new cannabis marketplace. CTV News. 2018 Nov 2, 2018.
7. Myran DT, Brown CRL, Tanuseputro P. Access to cannabis retail stores across Canada 6 months following legalization: a descriptive study. CMAJ Open 2019;7:E454–E61. doi:10.9778/cmajo.20190012.
8. Statistics Canada. Cannabis economic account, 1961 to 2017. 2018. Available from: https://www150.statcan.gc.ca/n1/daily-quotidien/180125/dq180125c-eng.htm [last accessed 22 July 2021].
9. Mahamad S, Hammond D. Retail price and availability of illicit cannabis in Canada. Addict Behav 2019;90:402–08. doi:10.1016/j.addbeh.2018.12.001.
10. Armstrong MJ. Legal cannabis market shares during Canada's first year of recreational legalisation. Int J Drug Policy 2021;88:103028. doi:10.1016/j.drugpo.2020.103028.
11. Statistics Canada. National Cannabis Survey, fourth quarter 2018. 2019. Available from: https://www150.statcan.gc.ca/n1/daily-quotidien/190207/dq190207b-eng.htm [last accessed 22 July 2021].
12. Watson TM, Erickson PG. Cannabis legalization in Canada: how might 'strict' regulation impact youth? Drug Educ Prev Policy 2019;26:1–5. doi:10.1080/09687637.2018.1482258.
13. Government of Canada. Canadian Student Tobacco, Alcohol and Drugs Survey - Summary of Results for 2018 to 2019. 2020. Available from: https://www.canada.ca/en/health-canada/services/canadian-student-tobacco-alcohol-drugs-survey/2018-2019-summary.html [last accessed 10 July 2021].
14. Everson EM, Dilley JA, Maher JE, Mack CE. Post-legalization opening of retail cannabis stores and adult cannabis use in Washington state, 2009-2016. Am J Public Health 2019;109:1294–301. doi:10.2105/AJPH.2019.305191.
15. Freisthler B, Gruenewald PJ. Examining the relationship between the physical availability of medical marijuana and marijuana use across fifty California cities. Drug Alcohol Depend 2014;143:244–50. doi:10.1016/j.drugalcdep.2014.07.036.
16. Pedersen ER, Firth CL, Rodriguez A, Shih RA, Seelam R, Kraus L, Dunbar MS, Tucker JS, Kilmer B, D'Amico EJ, et al. Examining associations between licensed and unlicensed outlet density and cannabis outcomes from preopening to postopening of recreational cannabis outlets. Am J Addict. 2021;30:122–30.

17. Harpin SB, Brooks-Russell A, Ma M, James KA, Levinson AH. Adolescent marijuana use and perceived ease of access before and after recreational marijuana implementation in Colorado. Subst Use Misuse. 2018;53:451–56. doi:10.1080/10826084.2017.1334069.
18. Paschall MJ, Grube JW. Recreational marijuana availability in oregon and use among adolescents. Am J Prev Med. 2020;58:e63–e9. doi:10.1016/j.amepre.2019.09.020.
19. Shi Y, Cummins SE, Zhu S-H. Medical marijuana availability, price, and product variety, and adolescents' marijuana use. J Adolesc Health. 2018;63:88–93. doi:10.1016/j.jadohealth.2018.01.008.
20. Anderson DM, Rees DI. The role of dispensaries: the devil is in the details. J Policy Anal Manage. 2014;33:235–40. doi:10.1002/pam.21733.
21. Brooks-Russell A, Ma M, Levinson AH, Kattari L, Kirchner T, Anderson Goodell EM, and Johnson RM . Adolescent marijuana use, marijuana-related perceptions, and use of other substances before and after initiation of retail marijuana sales in Colorado (2013-2015). Prev Sci. 2019;20:185–93.
22. Wouters M, Benschop A, van Laar M, Korf DJ. Cannabis use and proximity to coffee shops in the Netherlands. Eur J Criminol. 2012;9:337–53. doi:10.1177/1477370812448033.
23. Hammond D, Goodman S, Wadsworth E, Rynard V, Boudreau C, Hall W. Evaluating the impacts of cannabis legalization: the International Cannabis Policy Study. Int J Drug Policy. 2020;77:102698. doi:10.1016/j.drugpo.2020.102698.
24. Groves RM, Fowler FJ, Couper MP, Lepkowski JM, Singer E, Tourangeau R. Survey Methodology. 2nd ed. John Wiley & Sons; 2009.
25. American Association of Public Opinion Research (AAPOR). Online Panels. 2018 Available from: https://www.aapor.org/Education-Resources/Election-Polling-Resources/Online-Panels.aspx [last accessed 10 July 2021].
26. American Association for Public Opinion Research (AAPOR). Standard definitions: final dispositions of case codes and outcome rates for surveys. 2016. Available from: https://www.aapor.org/AAPOR_Main/media/publications/Standard-Definitions20169theditionfinal.pdf [last accessed 9 July 2021].
27. Goodman S, Burkhalter R, Hammond D International cannabis policy study technical report - wave 2 (2019). Waterloo, ON, Canada: University of Waterloo; 2020.
28. Goodman S, Hammond D international cannabis policy study technical report - wave 1 (2018). Waterloo, ON, Canada: University of Waterloo; 2019.
29. 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 [last accessed 9 July 2021].
30. Benjamini Y, Drai D, Elmer G, Kafkafi N, Golani I. Controlling the false discovery rate in behavior genetics research. Behav Brain Res 2001;125:279–84. doi:10.1016/S0166-4328(01)00297-2.
31. Wadsworth E, Driezen P, Goodman S, Hammond D. Differences in self-reported cannabis prices across purchase source and quantity purchased among Canadians. Addict Res Theory 2020;28:474–83. doi:10.1080/16066359.2019.1689961.
32. Capler R, Walsh Z, Crosby K, Belle-Isle L, Holtzman S, Lucas P, Callaway R. Are dispensaries indispensable? Patient experiences of access to cannabis from medical cannabis dispensaries in Canada. Int J Drug Policy. 2017;47:1–8.
33. Bensadoun E, Sandri E Toronto's crackdown on ilegal pot shops has resulted in 41 charges so far. Toronto Star. 2019 April 17, 2019.
34. Leos-Toro C, Rynard V, Murnaghan D, MacDonald JA, Hammond D. Trends in cannabis use over time among Canadian youth: 2004-2014. Prev Med 2019;118:30–37. doi:10.1016/j.ypmed.2018.10.002.
35. Rotermann M. What has changed since cannabis was legalized? Statistics Canada, Catalogue no. 82-003-X. Health Rep. 2020;3:11–20.
36. Goodman S, Wadsworth E, Leos-Toro C, Hammond D. International cannabis policy study. Prevalence and forms of cannabis use in legal vs. illegal recreational cannabis markets. Int J Drug Policy 2020;76:1026. doi:10.1016/j.drugpo.2019.102658.