The Legalization of Cannabis in the Canadian National Accounts

Conrad Barber-Dueck
(Statistics Canada)

Ian Donegan
(Statistics Canada)

Philip Smith
(Statistics Canada)

James Tebrake
(Statistics Canada)

Catherine Van Rompaey
(Statistics Canada)

The Legalization of Cannabis in the Canadian National Accounts

Conrad Barber-Dueck, Ian Donegan, Philip Smith, James Tebrake and Catherine Van Rompaey

Statistics Canada

Legalization of Cannabis in the Canadian National Accounts[1]

1. Introduction

In April 2017 the Government of Canada tabled legislation in the House of Commons to legalize, regulate and restrict access to cannabis for non-medical purposes. The licenced production and consumption of cannabis for medical purposes has been legal since 2001[2][3][4]. While illegal cannabis consumed for non-medical purposes falls within the SNA production boundary, a lack of available information to produce reliable estimates precluded its inclusion in the Canadian national accounts.

This paper describes the journey towards legalization of cannabis in the Canadian Macroeconomic Accounts program. This includes the development of early experimental estimates of illegal activity based on models and non-traditional sources, along with the use of innovative mechanisms to validate the assumptions required in their construction. It will cover measurement strategies leading up to and beyond the point of official legalization, along with plans for implementation in the core Canadian national accounts. Both substantive and operational challenges will be reviewed, including the development of an effective transparent communication strategy leading up to the release of the first official estimates in Canada.

---

[1] The authors wish to thank Naz Kazi, Ryan MacDonald, Anthony Peluso and Michelle Rotermann of Statistics Canada for their helpful review and input to the paper.

[2] Library of Parliament. *Medical Marijuana: A Timeline*. Available at: https://lop.parl.ca/Content/LOP/ResearchPublications/tips/tip108-e.htm

[3] Health Canada. *Understanding the New Access to Cannabis for Medical Purposes Regulations*. Available at: https://www.canada.ca/en/health-canada/services/publications/drugs-health-products/understanding-new-access-to-cannabis-formedical-purposes-regulations.html

[4] Health Canada. *Procedures for Accessing Cannabis for Medical Purposes from a Licensed Producer*. Available at: https://www.canada.ca/en/health-canada/services/drugs-health-products/medical-use-marijuana/procedures-accessing-cannabis-medicalpurposes-licensed-producer.html

2. Context

On June 30, 2016, the Government of Canada launched a task force on Cannabis Legalization and Regulation, which published a report in December 2016. Bill C-45, the *Cannabis Act* was subsequently introduced into the House of Commons in April 2017. It was passed by the House and referred to the Canadian Senate in November, and Royal Assent was granted on June 21, 2018.[5] While the act was originally envisaged to come into effect in July, this date was eventually pushed forward to October 17, 2018.

The Cannabis Act creates a control framework surrounding the production and distribution of non-medical Cannabis covering the following key elements:

- Prohibition on access for youth under 18 years of age
- Specific controls on access for adults of legal age regarding possession and home cultivation
- Oversight and regulation of the industry via federal licences, control of distribution established by Canadian provinces and territories subject to federal conditions
- Regulation of the supply chain, quality controls and a national tracking system
- Penalties on unauthorized distribution and access to minors to protect public safety

Enactment of the Cannabis Act makes Canada the first G7 country to legalize non-medicinal cannabis officially on a national basis.[6]

As the legalization debate progressed, the need for credible statistical measures to inform the policy development became more urgent. This had important implications for the national statistical system, from both an economic perspective, to understand the size of the potential non-medical market and economic impacts over the transition to legalization, but also from a social perspective to understand implications for population health and public safety.

In the context of the national accounts, the legalization of cannabis poses a significant and interesting measurement challenge. Other than a relatively small amount of legal medicinal cannabis, illegal activity surrounding the production, consumption and distribution of cannabis was not included explicitly in published economic time series.[7] Neither had it been studied extensively to date. To understand the true economic impact, it was necessary to include non-medical cannabis in core SNA time series both prior to and subsequent to the point of legalization. A mechanism to track economic effects throughout the transition was needed, as part of a feasible and transparent strategy tying into production processes

---

[5] See http://www.parl.ca/DocumentViewer/en/42-1/bill/C-45/royal-assent

[6] The only other country to officially legalize cannabis for non-medical purposes is Uruguay. In the Netherlands, cannabis is a controlled substance and its production and consumption are misdemeanors, punishable by fines, but this has not been enforced for many years. In the United States, the cultivation, transportation, sale, possession and use of cannabis are illegal under federal law, but legal in several states.

[7] While this activity is not accounted for explicitly, it is likely that some is included indirectly, misallocated to other activities. This could be the result of hidden activity through legitimate businesses ("money laundering") or could occur via the national accounts compilation process, through the use of balancing identities in deriving aggregate estimates.

and revision policies across the integrated macroeconomic accounts. This undertaking involved coordinated effort across complex and inter-dependent programs, including the quarterly income and expenditure accounts, monthly production based GDP by industry and supply and use tables required for benchmarking the accounts.

There were urgent demands to develop early experimental estimates, using models and assumptions, to be improved over time as new information became available. These statistics were needed not only to inform important policy questions, but to help identify information gaps to ensure credible measures were developed for inclusion in official national accounts estimates. This would entail stepping outside the traditional bounds of a national statistical organization to introduce bold and innovative techniques in a timely manner to respond to these important information needs.

As new measures were scoped out and developed, they had to be communicated in a proactive and transparent manner that engaged the user community in the validation process. It was also critical to engage policy partners both at the federal level and in the regions, in terms of securing the required source data from the regulatory and tracking system being developed, but also to validate new estimates and understand the implications of new evidence as it became available.

This ongoing work occurred in the context of heightened and sustained media attention and a growing public appetite for more and better information as the legislation passed through the stages of ratification and the public debate accelerated.

3. Preparing the statistical system

As a necessary prelude to developing robust macroeconomic measures, a broad examination of the statistical system must be undertaken to determine what statistical infrastructure must be put in place, what statistical vehicles require adjustment and what new collection must be initiated to fill measurement gaps.[8]

Important information gaps to address included, for example:

- *What is the size of the non-medical market pre- and post-legalization?*
- *What happens to the 'underground' cannabis market after legalization?*
- *How healthy is the cannabis 'industry'? How many people does it employ? How many cannabis producers are there and how is this evolving?*
- *How many Canadians are growing their own cannabis?*
- *How much are governments spending to enforce cannabis-related laws and regulations?*
- *How much will governments raise in tax revenues from the sale of cannabis?*
- *How much will the legalization of non-medical cannabis add to GDP?*

Albeit very small (about 0,02% of GDP), the existing legal (medical) cannabis industry serves to advance measurement of cannabis producers well ahead of legalization. Large producers are already well-defined on Statistics Canada's Business Register and a profiling survey helped us understand the industry. Without this understanding, our knowledge of the cannabis market would be largely confined to the demand side, and an understanding of medical cannabis producers gave us an advance perspective on the post-legalization production function.

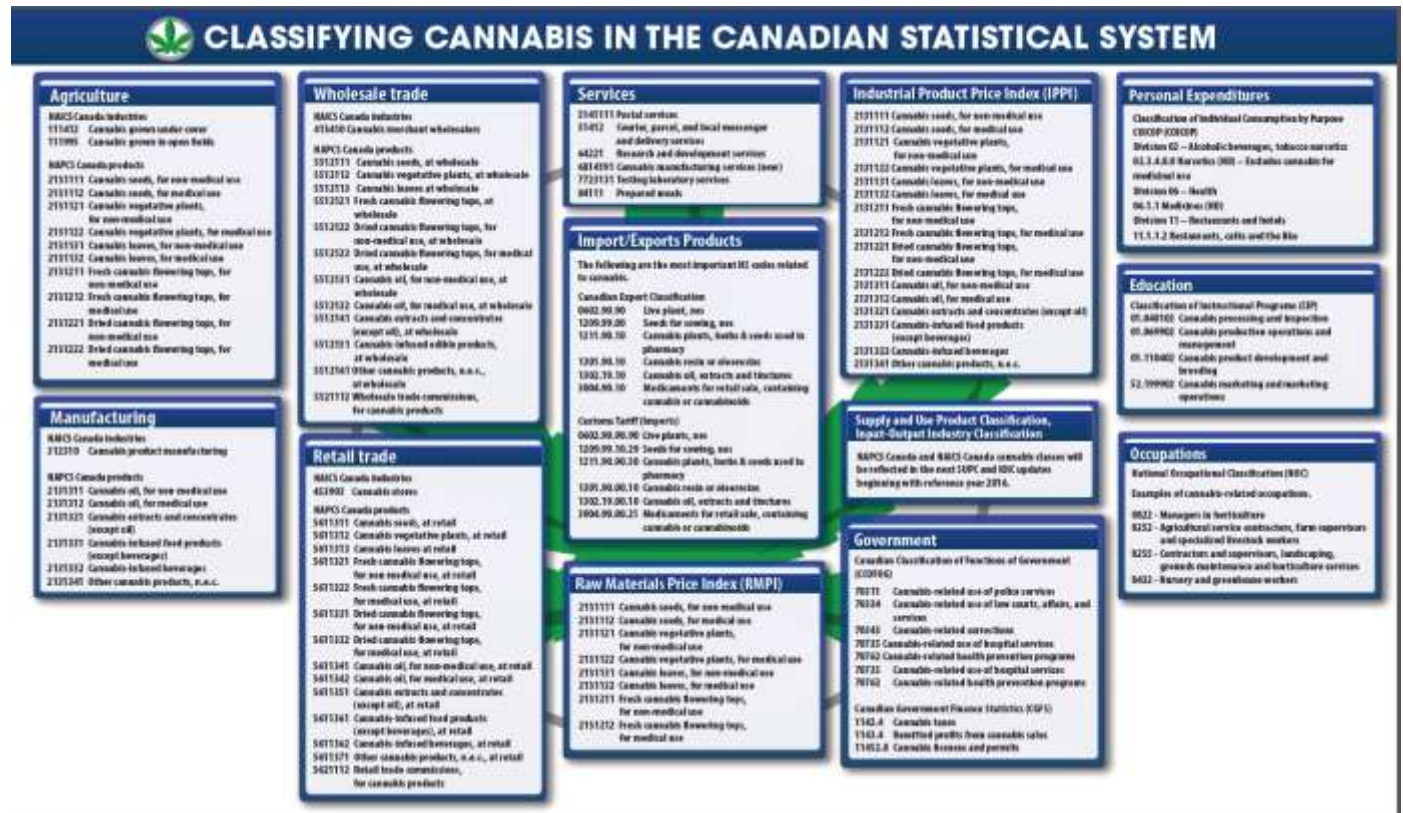**Statistical Infrastructure**

Classification systems

Updates were required to basic product and industry classification systems to build the detail required to account for cannabis activity. These classifications are established via tripartite coordination between Canada, the United States and Mexico. While illegal goods and services are out of scope for the North American Product Classification, legalization prompted a re-examination and the legal framework was clarified in late 2016. While the essential organizing principle is ideally physical characteristics (e.g. THC content, dried flower/leaf vs alternative forms, e.g. liquid/solid concentrates etc.) pragmatic considerations and user requirements for a purpose-type distinction between medical and non-medical cannabis were also important consideration. In the case of industries, organizing criteria ideally pertain to input structures, labour skills required and production processes. The legal (medical) and illegal (non-medical) 'industries' undoubtedly face different production functions, which can be expected to evolve as previously illegal activity comes above board.

---

[8] Statistics Canada. 2017. *Preparing the statistical system for the legalization of cannabis*. Latest Developments in the Canadian System of National Accounts. Statistics Canada Catalogue no. 13 605-X. Ottawa, Ontario. Available at: http://www.statcan.gc.ca/pub/13-605-x/2017001/article/14840-eng.htm (accessed July 23rd 2018).

Other statistical classifications requiring updates included those surrounding the Consumer Price Index (CPI), the Canadian variants of COICOP (required detail for household expenditures) and COFOG (cannabis related activities for health care, law enforcement and public education by governments), GFS (revenues from new excise taxes and relevant expenses) along with clarifications to classifications for international trade (HS codes) and household health surveys covering relevant subject matter.

A classification framework surrounding Cannabis was published by Statistics Canada in June 2018 and is summarized in the diagram below.

9

9 Statistics Canada. 2018. *Classifying Cannabis in the Canadian Statistical System.* Available at: http://www.statcan.gc.ca/eng/subjects/standard/cannabis/cannabis (accessed July 23th 2018).

Statistics Canada's business register, source data and collection instruments

Statistics Canada's business register contains information about over two million Canadian businesses of significant size, including contact details as well as the industry code, employment and other profiling information. It is a key piece of infrastructure to design and conduct business surveys. While the number of producers of cannabis products licenced for medical purposes was initially fairly restricted, these producers would eventually also be authorized to serve the non-medical market, and new licenses would be issued to meet anticipated demand. All producers in the nascent 'industry' must be accounted

for as it continues to grow and evolve. Tracking these units was to be accomplished via in partnership with Health Canada, the federal department responsible for regulating all Cannabis producers.

As is the case in other statistical endeavours, administrative databases must be exploited to the extent possible to meet data requirements, to minimize response burden and secure high-quality source information. This pertains principally to the use of regulatory data on the production, sale and distribution of licenced cannabis producers, as well as policing data from the Royal Canadian Mounted Police and other authorities that shed light on illegal activity.

Necessary updates to existing data collection instruments were made in a variety of areas, driven by the classification changes outlined above. This included price indexes and existing annual and sub-annual agriculture, manufacturing, wholesale and retail surveys to appropriately account for production, sales and inventories. Household and business surveys designed to measure labour, other production costs and profits, along with business investment were also reviewed and adjusted as required. Statistical outputs for government revenues and expenditures were expanded to identify relevant cannabis-related activities and while export activity is expected to be minimal and restricted to medicinal cannabis, measures of international trade will be monitored and outputs elaborated if required.

New surveys were required to collect the characteristics of licenced producers, beginning with medical cannabis producers in 2017. The Medical Cannabis Producers Survey, 2016 collected information about industry structure, production, sales, employment, current and future investment and other economic characteristics in fiscal years 2015-16 and 2016-17. It was replaced by the Licenced Cannabis Producers Survey for the 2017 reference year.

In addition, cannabis consumption of individuals (irrespective of legality) was measured via the Canadian Tobacco, Alcohol and Drug Survey (CTADS) in 2017.[10] In order to track consumption patterns on a quarterly basis throughout the transition to legalization, a quarterly household survey, the National Cannabis Survey,[11] was undertaken beginning in the first quarter of 2018 to track household consumption throughout the year. First results were released in April 2018.

A number of external studies and outside sources were consulted to validate the estimates and consumer prices were initially drawn from a public crowdsourcing website, *PriceofWeed.com*. As will be discussed later in the document, Statistics undertook its own crowdsourcing initiative to anonymously collect information on cannabis purchases via an interactive statistical web application, along with other innovative initiatives to measure drug use.

---

[10] This is part of ongoing monitoring of cannabis and other drugs in collaboration with Health Canada since 2004.

[11] Statistics Canada collaborated with partners in Health Canada, Public Safety Canada and the Public Health Agency of Canada to undertake this work.

4. Building estimates in a national accounts framework

As noted above, given the integrated nature of Canadian national accounts, there was a need to develop a cross-cutting, operationally feasible strategy covering the range of integrated products across the Macroeconomic accounts statistical program. This includes the quarterly accounts, monthly production based GDP by industry and annual regional Supply and Use tables, and must tie in with production schedules and revision policies for core official estimates.

As a mechanism to accomplish this, early experimental estimates were built in the form of a satellite account. This allowed Statistics Canada to communicate findings in a transparent manner prior to official implementation and also to proactively seek feedback from the user community. The satellite account, termed the *Cannabis Economic Account* was developed with core SNA requirements in mind.

To understand developments over the transition to legalization, ideally a consistent time series of both medical (legal) and non-medical (illegal) production, consumption and distribution is required. As it stands at the point of writing, a two-phased approach is envisaged for implementation of non-medical cannabis in the core SNA:

1. Non-medical cannabis is to be included and explicitly identified in core accounts at the point of legalization, which results in a time-series break as previously illegal activity comes above-board. The Cannabis Economic Account and quarterly National Cannabis Survey will serve as complimentary information to shed light on the transition in the short term.
2. A full quarterly time series of non-medical cannabis will be implemented in the core accounts back to the year 1961 in a subsequent phase, corresponding with the comprehensive revision already targeted for the fall of 2019.

Compiling a cannabis economic account[12]

The development of a cannabis economic account is a challenge due to a lack of available source data since both the production and consumption of non-medical cannabis are presently illegal in Canada. The lack of economic data for the non-medical market implies that models and assumptions must be developed drawing on self-reported information on cannabis use (prevalence) from health and drug use monitoring surveys and translated into estimates of output and consumption. Estimates produced are therefore model-derived, relying on assumptions with wide margins of error.

Information on the output and consumption of cannabis for medical purposes poses less of a challenge. This is currently contained within Canada's official economic accounts but is not visible since these activities are comparatively small and are grouped with other related activities. For example, household spending on medical cannabis is included with household spending on other medicines. Estimating the

---

[12] Tebrake, J. 2017. *A cannabis economic account – The framework.* Latest Developments in the Canadian Economic Accounts. Statistics Canada Catalogue no. 13-605-X. Ottawa, Ontario. Available at http://www.statcan.gc.ca/pub/13-605-x/2017001/article/54881-eng.htm (accessed July 23rd 2018).

output and consumption of medical cannabis therefore involves extracting existing detail on the medical cannabis sector from existing core national accounts statistics. This involves using information from the licensed medical cannabis producers in Canada and regrouping it into a medical cannabis industry.

Sources and methods: medical cannabis

The consumption of cannabis for authorized for medical purposes has grown substantially in recent years. Health Canada first established regulations on access to cannabis for medical purposes in 2001. This regulatory framework has undergone a number of changes since then, most notably in 2014 and 2016.[13]

Currently there are 114 licensed producers serving this market (as of July 24, 2018). The number is growing rapidly in anticipation of the legalization of cannabis for non-medical use in mid-2018. The licensed producers advertise their products on web sites and fill orders by mail. Authorized individuals typically submit their orders to licensed producers online or by mail. There are no retail or wholesale intermediaries. Importation and exportation of cannabis for medical purposes is rare and requires special circumstances (e.g. research projects) and government permits.[14]

It is relatively straightforward to develop a set of economic accounts for this market. Administrative data are available on output, sales and inventories in volume terms from monthly reports submitted to Health Canada by the licensed producers. As well, the number of registered consumers are also reported to Health Canada providing a reasonable estimate of the current number of legal consumers in Canada.[15]

Corporate income tax data are also available for these producers, although with a significant lag. In addition, Statistics Canada conducted a pilot survey of this group of producers to provide information about the value of their sales, expenses, profits, investments and product lines. Information from consumers of medical cannabis is provided through the StatCannabis application and the National Cannabis Survey.

This information is combined with prices collected from the StatCannabis application, PriceofWeed.com and the National Cannabis Survey to derive the expenditure estimates for medical cannabis used in the economic account. These estimates are compared against output data collected from the Medical Cannabis Producers Survey to confront the assumptions used to develop them.

Sources and methods: non-medical cannabis

As noted previously, unlike the medical cannabis industry, there are few economic data related to the output and consumption of non-medical cannabis available in Canada. Accordingly, the illegal cannabis industry was modelled using mostly health and drug use monitoring survey data as a starting point. The

---

[13] Health Canada. *Understanding the New Access to Cannabis for Medical Purposes Regulations*. Available at: https://www.canada.ca/en/health-canada/services/publications/drugs-health-products/understanding-new-access-to-cannabis-formedical-purposes-regulations.html

[14] Health Canada. *Licensed Producers Market Data*. Available at: https://www.canada.ca/en/health-canada/services/drugs-health-products/medical-use-marijuana/licenced-producers/market-data.html

[15] Users can register with more than one licensed producer and the therefore the number of registrants will typically exceed the number of authorized users.

following section highlights the data sources, methods and models used to derive the part of the cannabis economic account focusing on illegal output and consumption.

Non-medical cannabis: estimates of Canadian household expenditures

Fortunately, Canada has collected a significant amount of information from Canadians over the last 50 years related to cannabis consumption. This information was used to develop a time series of cannabis use prevalence among Canadians. This work draws on an estimation strategy used by international organizations and researchers, in addition to its use by the Office of the Parliamentary Budget Officer to forecast consumption for Canada in the period following legalization.[16] The volume of cannabis consumption is estimated based on prevalence and frequency of use data, largely from national and provincial health and drug use monitoring surveys, linked over time using statistical techniques and combined with assumptions about consumption behaviour. Annual estimates were prepared by age group by Statistics Canada's Analytical Studies branch, and served as a key element in building the Cannabis Economic Account. Evaluation of available survey sources and detailed explanations of the estimation approach were released by Statistics Canada in December 2017 and February 2018.[17]

Given the objective is to measure the *value* of cannabis consumed by Canadians in a given year, three essential pieces of information are required—the use prevalence or number of consumption episodes per year, the volume consumed per consumption episode and the price. Use prevalence is the number of people who consume combined with the frequency with which they consume. To turn the prevalence into an estimate of the value of cannabis consumed, several steps are required:

1. The *number of consumers* is estimated by multiplying the prevalence by the population.
2. The number of consumers *by frequency* is estimated.
3. The number of *consumption days by frequency* is calculated.
4. An estimate of the *amount of cannabis consumed* based on the frequency of consumption is used to estimate the volume of consumption, by multiplying the number of consumer days by the volume consumed for each consumption frequency.
5. The *value of consumption* is measured by multiplying the price of cannabis by the quantity consumed.

For example, if the prevalence measure indicates that one million Canadians consume cannabis on a daily basis, then to derive a volume measure for the year the number of grams consumed daily must be multiplied by the number of days in the accounting period, 365 in the case of a year. Then, assuming that on average Canadians who consumed cannabis each day consumed one gram per day, the volume of consumption is estimated as 265,000,000 grams. Finally, the third piece of information required to derive a measure of household expenditure on cannabis is the price paid per unit. In the example, to

---

[16] Office of the Parliamentary Budget Officer (PBO). 2016. Legalized Cannabis: Fiscal Considerations. Ottawa, ON

[17] Please see Macdonald R. Rotermann M. *Experimental estimates of cannabis consumption in Canada, 1960 to 2015*. Economic Insights. Available from https://www150statcan.gc.ca/n1/pub/11-626x2017077-eng.htm and Macdonald R. Rotermann M. Constructing Historical Cannabis Consumption Volume Estimates for Canada, 1960 to 2015. Available from https://www150.statcan.gc.ca/n1/eng/catalogue/11-633-x2018015

calculate expenditure an average price per gram is required. Assume the average price in the year was $8 per gram. Then the calculation of household expenditure on cannabis for the year is as follows: 1,000,000 (number of people) * 365 (number of consuming days) * 1 (grams consumed per consuming day) * $8.00 (price per gram) = $2,920,000,000.

The method outlined above was used to construct the measure of household consumption in value terms in the cannabis economic account. It can be summarized algebraically in the following equation:

$$C = P \times Q = P \times \sum i \, (Pop \, i \times \sum j \, (Days \, j \times Grams \, j \,))$$

where,

- C = Value of total household consumption of cannabis (expenditure) in the period.
- P = Average price of cannabis in the period.
- Q = Quantity of cannabis in the period.
- Pop_i = Consuming population in demographic group i in the period.
- $Days_j$ = Number of consuming days in frequency-of-use category.
- $Grams_j$ = Average grams per day consumed by a user in frequency-of-use category j, to be determined.
- The frequency-of-use categories are j = once a year, less often than once a month, one to three times a month, at least once a week, daily.

Non-medical cannabis: deriving estimates of output, gross domestic product, imports and exports

There was never a question that illegal, non-medical cannabis was produced in Canada. A quick review of the justice statistics points to raids on grow houses and other illegal production facilities.[18] Even though the activity is illegal, it is still "economic output" and according to the international SNA 2008 standard should be included in Canada's GDP. However, the output and distribution of cannabis have always been excluded because it was assumed to be relatively insignificant and there were limited data available to produce accurate measures. While the problem of limited information still exists, the insignificance argument (both as a social phenomenon and as an economic one) no longer holds. It is time to include the activity, yet prior to legalization the limited source data problem persists.

The legalization of cannabis should eliminate or substantially restrict the illegal cannabis market, but if that occurs it will take time. While the adjustment proceeds there will be an interest in measuring the rate of progress toward the objective. Moreover, there will be an overstatement of economic growth in the estimates of GDP in the initial months and quarters after legalization, as measured legal output substitutes for some of the previously unmeasured illegal output. For both of these reasons there will be a continuing need for estimates of illegal cannabis output and consumption beyond the point of legalization, for at least the next few years.

Fortunately, there is a direct relationship between household consumption expenditure and the output of cannabis and this relationship is exploited along with some realistic assumptions to develop a model to estimate the domestic output, imports and exports of non-medical cannabis in Canada.

---

[18] Mawani, F., Maslov, A. and A. Lawrence. 2017. Measuring Illicit Cannabis Seizures in Canada. Research Report 2017-R002. Public Safety Canada. Ottawa. ON.

The model is built on a cornerstone national economic accounting identity: that the supply of a product to an economy must equal its use by that economy. More explicitly, within the macroeconomic accounting framework any good that is supplied to the economy, through either domestic output or imports, has a limited number of uses, namely:

- As an input to the output of other goods and services— intermediate consumption.
- As consumption by households as part of final consumption expenditure.
- As consumption by governments or non-profit institutions serving households in the provision of their services.
- As a source of wealth (capital) in which case it is used repeatedly over the course of more than a year in the production of other goods and services.
- As inventory.
- As exports.

In the case of non-medical cannabis, it is unlikely that a significant amount of the illegal drug is an input into subsequent processing and therefore it is assumed that it does not enter intermediate consumption. It is further assumed that governments and non-profit institutions serving households do not purchase non-medical cannabis in significant quantities as an input into the production of their services. Cannabis is not used as a capital asset to produce other goods and services.[19] Changes in the amount of illegal cannabis held in inventory may sometimes be significant, as a result of large drug busts for example, but over a period of several years inventory fluctuations are likely to cancel out and be unimportant. Given this, our model assumes that prior to legalization there are only two uses for non-medical cannabis—the cannabis that is produced in Canada or imported (smuggled) into Canada is either consumed by households or illegally exported. This is an important assumption since it means that the output problem reduces to an equation of four variables with only three unknowns because the level of household expenditure can be estimated from the use prevalence data as previously discussed.

The relationship between the supply of cannabis and the use of cannabis is illustrated in Figure 1 where the goal is to determine the supply of non-medical cannabis in the Canadian market along with the use. The supply can come from two sources—domestic output or imports. The uses as mentioned above can be either household consumption or exports.

Figure 1 Relationship between the supply of cannabis and the use of cannabis

Supply (millions of dollars)			Use (millions of dollars)	
Domestic output	Imports	=	Household expenditures	Exports

Source: Statistics Canada, "A cannabis economic account", *Latest Developments in the Canadian Economic Accounts* (13-605-X), 2017.

---

[19] While cannabis itself is not used as a capital asset, it bears mentioning that producers, both legal and illegal, are building substantial investments in intangible cannabis assets in the form of specialized cannabis strains and in hydroponic and other production techniques.

The supply=use equation requires that some household expenditure come from domestically produced non-medical cannabis and some from illegal imports. In addition, some domestically produced cannabis is illegally exported from Canada to other countries. In order to develop a full cannabis economic account, the import and export of non-medical cannabis into and out of Canada must be addressed.

Currently, there are no data available to indicate the amount of non-medical cannabis illegally imported into or exported out of Canada. Information is available from justice statistics related to seizures and arrests. The Canadian Center for Justice Statistics tracks the number of incidents related to violations of the *Controlled Drugs and Substances Act* and categorizes these incidents as output, importation and exportation, trafficking and possession. Unfortunately import and export seizures are not reported separately. There is limited data from Canadian Border Services for certain ports of entry. Nevertheless, it is possible to make reasonable assumptions about the relative importance of illegal imports and exports by examining these data.

Given assumptions about imports and exports and estimates of household consumption expenditure it is possible to solve the supply=use identity for output at purchaser price. To derive a measure of gross value added at basic price additional information is required. In particular, information is needed about (i) how much of domestic output is for own use rather than for sale on the illegal market, (ii) the margins associated with distributing and selling cannabis and (iii) the cost of the inputs used to produce cannabis.

Gross value added is defined as the value of output less the **intermediate inputs** that are required to produce the output. The value added related to non-medical cannabis can therefore be seen loosely as the value of the cannabis sold less the costs of the inputs. The intermediate inputs include costs related to the operation of the facility used to grow cannabis (electricity, water, fertilizer, etc.), costs associated with the purchase of seeds or plants and costs associated with renting facilities and equipment. Gross value added represents the contribution of labour and capital services to the total value of the cannabis produced as distinct from the value of purchased inputs which are, of course, the value added of producers of products other than cannabis.

When cannabis output is said to be measured **at basic price** that means it is valued at the price charged at the factory gate, before any wholesaling, retailing ("street dealer") and other margins are added into the price. In order to calculate gross value added at basic price the margins must be removed from the value of domestic output **at purchaser price,** in which the margins are included.

Production of cannabis for own final use refers to the non-medical cannabis that is grown and consumed by that same grower.

To move from domestic output at purchaser price to a measure of output for sale at basic price, the following must be estimated:

- margins;
- intermediate consumption; and
- shares of output that were produced for sale and for own final use.

Margins charged in the Canadian illegal cannabis industry are unknown. They might be higher than those in the legal medical cannabis industry, due to the risk premium associated with engaging in illegal activity, but this is difficult to determine. Different assumptions about margins are used to estimate upper and lower bounds for gross value added at basic prices.

To calculate value added for the illegal industry, the estimated value of the intermediate inputs used to produce cannabis is required. Again, since there are no data available for the various inputs used to produce non-medical cannabis, proxies and assumptions must be relied on. The medical cannabis industry input proportions could be used as a proxy for the non-medical cannabis industry. This would be defensible to the extent that similar inputs are required to produce cannabis whether the process is legal or illegal—seeds, fertilizers, water, electricity, etc. Based on results from the Medical Cannabis Producers Survey, 2016 it was determined that the legal producers face significantly different input costs given that the burden of regulation in much higher. Currently the input-output ratio for the greenhouse industry is used to estimate the inputs for the non-medical cannabis industry within the Cannabis Economic Account and provides a measure to derive value added for that segment.

Once the levels of output and intermediate consumption have been estimated it must be determined how much output was produced for own use (non-market output) and how much for sale in the market (market output). To estimate this split the medical cannabis industry provides a good proxy. Canadians who use medical cannabis can obtain a permit to grow their own cannabis or purchase cannabis from a licensed Canadian producer. To grow your own cannabis for medical reasons a certificate from Health Canada is needed. Health Canada also obtains information from licensed growers who sell to the public. Health Canada therefore has data on the percentage of medical cannabis consumers that use grown-for-own-use and the percentage that use purchased-on-the-market cannabis. The same proportions can be used as a proxy for the non-medical market. As potential for it to be higher (due to avoiding risk of illegally transacting or contaminated product) or lower (due to the risks of illegally growing).

Bringing all this information together makes it is possible to estimate the output of non-medical cannabis in Canada along with the corresponding gross value added, margins, imports and exports.

Algebraically these calculations can be summarized as follows:

$$Y\,purch = C + X - M$$

$$Y\,basic = Y\,purch \times (1 + DM)$$

$$GVA = Y\,basic \times (1 - IC\,share)$$

$$Y\,basic = NM \times Y\,basic + (1 - NM) \times Y\,basic$$

where,

- C = total household expenditure on legal and illegal cannabis.
- X = legal and illegal exports of cannabis.
- M = legal and illegal imports of cannabis.
- Y_{purch} = total output at purchaser price.
- Y_{basic} = total output at basic price.
- DM = dealer margins including trade, transportation and tax margins.
- GVA = gross value added.
- IC_{share} = share of intermediate consumption in total output at basic price.
- NM = share of non-market output (for own use) in total output at basic price.

The initial compilation of non-medical (illegal) cannabis required a number of **key assumptions,** to be validated over time as more evidence becomes available**:**

1. Cannabis is likely under-reported in health surveys, therefore the number of reported consumers must be adjusted upwards
2. The price of cannabis has been falling since the mid-1990s [20]
3. The price of cannabis for medical purposes is approximately 10% higher than cannabis for non-medical purposes
4. Approximately 1% of all cannabis purchased from abroad is seized at the border[21]
5. Approximately 0.05% of all cannabis sold abroad is seized at the border[22]
6. Canadian producers capture approximately 1.5% of the US market [23]

Variables estimated in the *Cannabis Economic Account* are as follows:

Medical Cannabis	Non-medical Cannabis
Supply	**Supply**
Production	Production
Market output	Market output
Own-use	Own-use
Margins	Margins
Imports	Imports
Use	**Use**
Household final consumption expenditure	Household final consumption expenditure
Exports	Exports

[20] Easton, S. (2004). Marijuana Growth in British Columbia. *Public Policy Sources, 74.*

[21] Bouchard, M (2008). Towards a realistic method to estimate cannabis production in industrialized countries. *Contemporary Drug Problems, 35.*

[22] Ibid.

[23] Easton, S. (2004). Marijuana Growth in British Columbia. *Public Policy Sources, 74.*

Provisional results for public release

Following the release of consumption volumes in December, the first provisional results of the Cannabis Economic Account were released in January 2018[24] and included a time series of annual estimates from 1961 to 2017. Results indicated that in 2017, about 4.9 million Canadians spent an estimated $5.7 billion on cannabis for both medical and non-medical purposes, equivalent to around $1,200 per cannabis consumer. The majority of household spending (over 90%) was on illegal cannabis for non-medical (non-medical) purposes. While the largest amount of cannabis was consumed by individuals aged 25 to 44, the share of those 45-64 has been steadily increasing over time. Time series indicate that the overall Canadian price of cannabis peaked in 1989 and has been trending downward since. It declined by an average of 1.7% per year since 1990 to an average of $7.50 per gram in 2017.

*Chart 1 – Expenditure and volume of cannabis consumed 1961 - 2017*
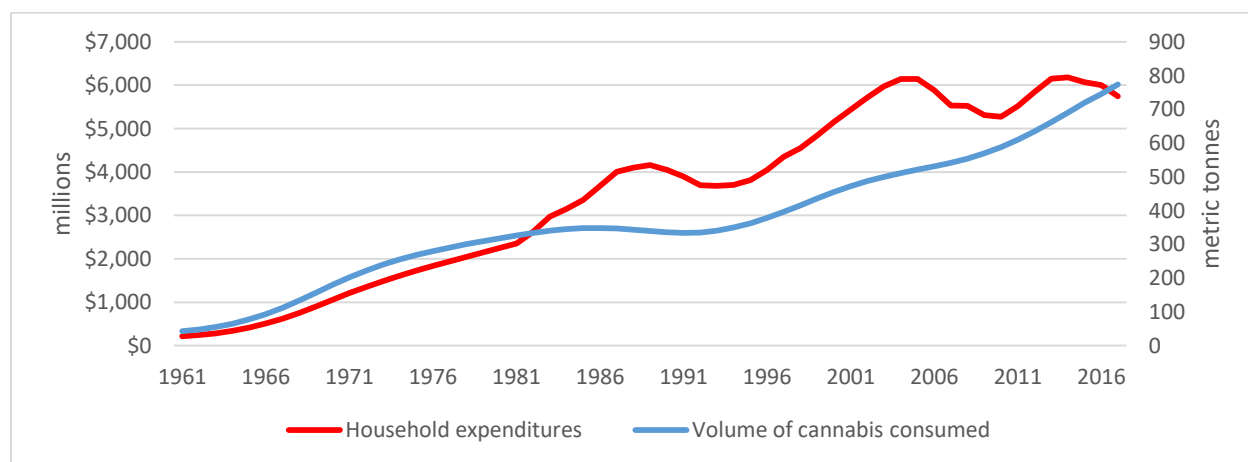
Most cannabis consumed in Canada is also produced in Canada, and a non-trivial amount of Canadian production (approximately $1.2 billion) was illegally exported in 2017. The value added of the cannabis 'industry' is estimated at $3.4 billion in 2017, on par with the domestic beer industry and larger than the tobacco industry. The majority of Canadian production was for illegal, non-medical purposes, estimated at $4.6 billion in 2017 versus just under $400 million for legal, medical purposes.

On April 30th, 2018 provisional results by province and territory were released, indicating disparities in production and consumption of cannabis across Canadian regions[25]. The province of Nova Scotia recorded the largest consumption per capita, while British Columbia was the largest producing province, contributing roughly 40% of national value added. Prices faced by cannabis consumers varied from coast to coast, with the highest prices in the northern territories of Northwest Territories and Nunavut.

---

[24] Statistics Canada. 2018, January 25. Cannabis Economic Account, 1961 to 2017. *The Daily*. Available at https://www150.statcan.gc.ca/n1/daily-quotidien/180125/dq180125c-eng.htm (accessed July 23rd 2018).

[25] Statistics Canada. 2018, April 30. Provincial and Territorial Cannabis Economic Accounts, 2017. *The Daily*. Available at https://www150.statcan.gc.ca/n1/daily-quotidien/180430/dq180430b-eng.htm (accessed July 23rd 2018).

Chart 2 – Consumption per capita by province and territory
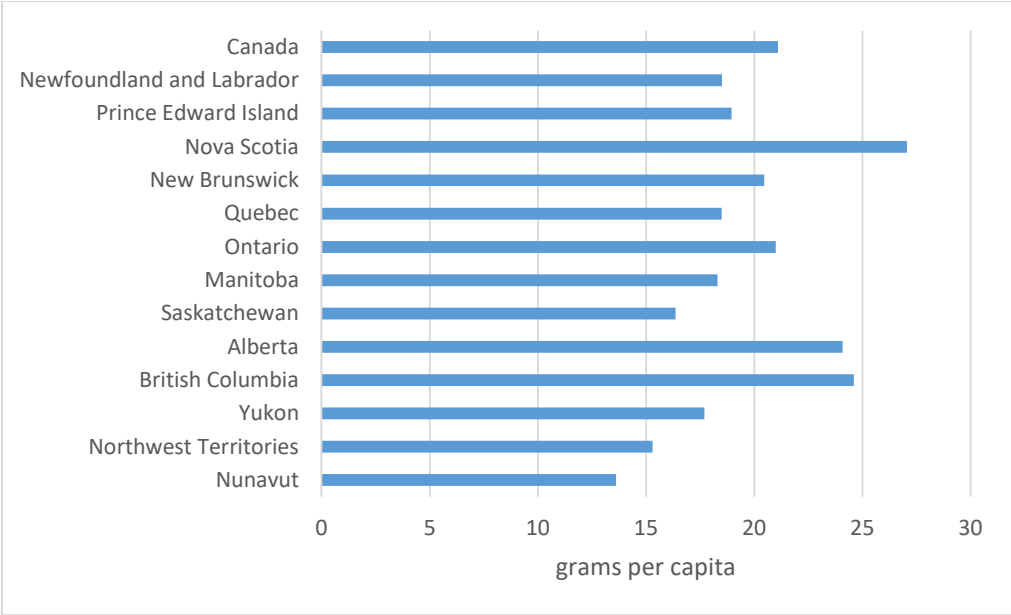
5. Strategies for effective communication and user engagement

Cannabis statistics hub

As a mechanism to proactively disseminate information to the public as it became available, an interactive dissemination product was developed, the *Cannabis Statistics Hub* and released in January 2018. It now features prominently on the Statistics Canada's home page. As shown below, the hub is intended as a vehicle to disseminate all information pertaining to cannabis released by Statistics Canada, and includes four components containing statistics and research studies on health, justice, economy and prices.

The "Economy" segment, pictured below, houses information from the Cannabis Economic Account described earlier, in addition to pertinent data on the number of consumers, the characteristics of licenced producers and other statistics, all accessible via a user-friendly, intuitive and interactive interface. In the dissemination of material via the hub, all efforts were made to ensure maximum transparency in how early experimental estimates were constructed. It contains links to classification structures along with detailed sources and methods documentation containing all the key assumptions and caveats regarding data quality.

Cannabis Stats Hub

| Health | Justice | Economy | Prices |

The following are **experimental estimates** of the household consumption expenditure of Canadians on cannabis for the years 1961 to the present. These data are based on information obtained from numerous health surveys where Canadians reported their use of cannabis. Consult the notes section for more information.

Household consumption expenditure
2017

Total, 15 years and over

Expenditure	$5,526.6 million
Quantity	773.41 t
Price per gram	$7.15

(click on indicators to update the chart on this page)

Expenditure — Total, 15 years and over
2017

$ millions

Household consumption expenditure
Production
Licensed producers (LPs)
Number of consumers
Classifications

As a mechanism to both emphasize the experimental nature of the data and promote user engagement, the hub allows interested data users to adjust assumptions and regenerates estimates of household consumption based on their choices.

As will be described in more detail later, the Cannabis Stats Hub also houses a crowdsourcing application that anonymously collects and disseminates information on cannabis purchases, irrespective of legality, directly from website visitors. Take up on this feature exceeded expectations, and results have been reported in official releases by Statistics Canada.

19

Household consumption expenditure
2017 — User defined calculation

Total, 15 years and over

Expenditure	$11,058.9 million
Quantity	773.31
Price per gram	$14.30

(click on indicators to update the chart on this page)
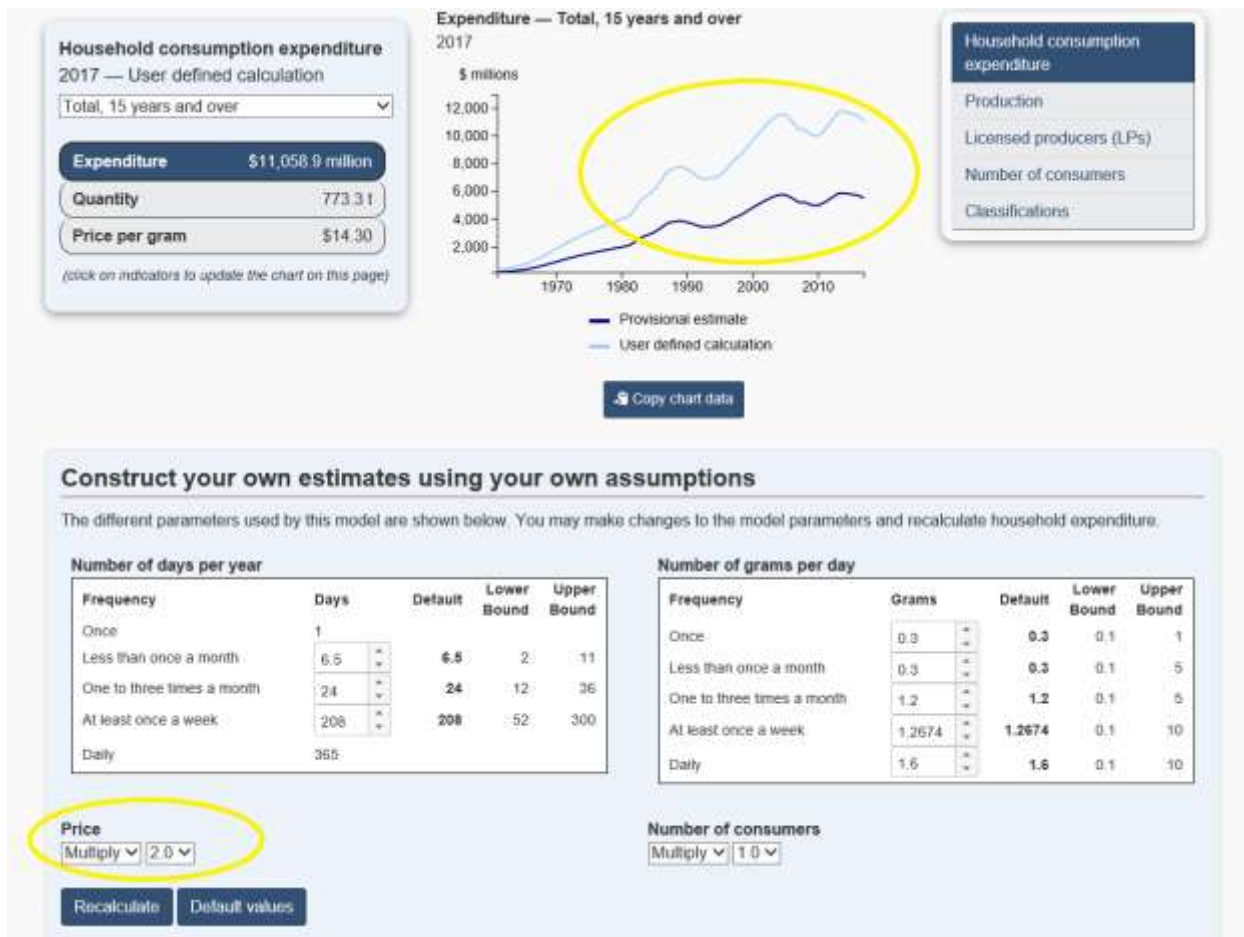
Expenditure — Total, 15 years and over
2017

$ millions

Household consumption expenditure
Production
Licensed producers (LPs)
Number of consumers
Classifications

— Provisional estimate
— User defined calculation

Copy chart data

Construct your own estimates using your own assumptions

The different parameters used by this model are shown below. You may make changes to the model parameters and recalculate household expenditure.

Number of days per year

Frequency	Days	Default	Lower Bound	Upper Bound
Once	1			
Less than once a month	6.5	6.5	2	11
One to three times a month	24	24	12	36
At least once a week	208	208	52	300
Daily	365			

Number of grams per day

Frequency	Grams	Default	Lower Bound	Upper Bound
Once	0.3	0.3	0.1	1
Less than once a month	0.3	0.3	0.1	5
One to three times a month	1.2	1.2	0.1	5
At least once a week	1.2674	1.2674	0.1	10
Daily	1.6	1.6	0.1	10

Price
Multiply 2.0

Number of consumers
Multiply 1.0

Recalculate   Default values

Proactive engagement with national and local media

As a measure of success in terms of generating public awareness of official statistics on the topic, given the appetite for information as the public debate on legalization of cannabis progressed, Statistics Canada received significant media coverage of the agency's activities in this area. Coverage was largely positive and served to heighten public awareness of the information released. Among the highlights was an article published in *The Economist*[26] on January 11, 2018, entitled *"StatCannabis – Measuring Canada's cannabis economy"*, a play on Statistics Canada's informal moniker "StatCan". This article (pictured below) described the statistical challenges facing the organization, and highlighted the significant work done so far leading to the release of the Cannabis Statistics Hub. It also introduced the term "StatCannabis", later taken up as the title for results released from the crowdsourcing application contained in the Cannabis Stats Hub.

---

[26] *Measuring Canada's cannabis economy.* The Economist. Available at: https://www.economist.com/the-americas/2018/01/11/measureing-canadas-cannabis-economy. Accessed July 23rd 2018

Figure 2– The Economist – Measuring Canada's cannabis economy

StatCannabis

Measuring Canada's cannabis economy

Recreational pot will soon be legal. Statisticians have to figure out how much it contributes to output

📖 Print edition | The Americas   Jan 11th 2018 | OTTAWA

National media picked up Statistics Canada's Cannabis releases, and coverage continued at a rapid pace between January and April, with sustained high profile reports by Canada's national broadcaster, the CBC, Global news, the National Post and a range of other outlets. Releases were also covered extensively in local media, particularly regarding regional differences in consumption and prices. Coverage also extended to non-traditional outlets, such as social media focused groups including *Vice* and *The Huffington Post,* who ran a series of articles in the spring of 2018.

Statistics Canada management and staff participated in numerous media interviews, including for national and local television, generating interest and further enhancing public discourse. A sample of headlines is pictured below.

Figure 3 – Sample of media reports, January – June 2018

FINANCIAL POST

StatsCan is having sewage water tested for THC to gauge how much marijuana we're using

It's like a drug test on eight million people

Nova Scotians smoke the most weed per capita in Canada: StatsCan

BUSINESS

Cannabis Prices In Canada Are Way Lower Than In The U.S., Data Shows

VICE News

Canada smokes even more weed than the government thought

Canadians spent $5.7B on marijuana last year, StatsCan estimates

Almost 5 million Canadians consumed marijuana last year, according to StatsCan

Paul Evans · CBC News · Posted: Jan 25, 2018 5:00 AM ET | Last Updated: January 25

Colby Cosh: What Chicago piano tuners have in common with Canadian weed dealers

Statistics Canada has tackled a tricky but important question: how much marijuana have Canadians been consuming?

6. Opportunities for modernizing measurement

The overall cannabis project represented an opportunity to advance leading edge statistical methods, and it was recognized as one of four "*pathfinder*" projects selected as test-cases for advancing the objectives of Statistics Canada's modernization initiative[27].

Two important examples of non-traditional methods employed in this context include the use of wastewater analysis to measure drug consumption levels in the general population and crowdsourcing approaches to measure the price of cannabis. This section outlines these examples in detail and presents preliminary results for the price of cannabis obtained via crowdsourcing.

Using wastewater to measure drug use

The use of wastewater to measure drug use is not new, having been performed in various countries for over 10 years. The European SCORE network (Sewage analysis CORe group – Europe), established in 2010 for the study of wastewater epidemiology, and is both a pioneer and the worldwide authority on the measurement of population consumption of illicit drugs. In 2016, SCORE participants conducted analyses in over 70 cities in more than 28 countries, including Canada, covering various drugs such as cannabis, opioids, cocaine, amphetamines, MDMA/ecstasy and new psychoactive substances. Over time, SCORE has refined its protocols for the collection, handling and analysis of wastewater, including the accreditation of participating laboratories.

The methodology is relatively straightforward, at least conceptually. Typically, daily samples are combined over time, to provide a stable measure of drug consumption. In addition, samples may be combined over various wastewater treatment plants serving a metropolitan area, to ensure representative coverage. Samples are collected; the flow at the time of collection is recorded; and the samples are refrigerated, documented and sent to the laboratory for analysis. The results are then fed into a model—using wastewater flow, pharmacokinetic (which determine the fate of drugs in the organism) and population estimates—to arrive at an overall estimate of drug consumption per person. Statistics Canada is adopting this methodology for the measurement of cannabis use by Canadians as well as opioid consumption owing to the urgency of its health impacts.

Estimates of drug consumption from municipal wastewater have a number of excellent statistical properties including:

- low collection costs;
- no burden on household or business respondents;
- no infringement of personal privacy or confidentiality;
- real-time reporting;
- low or no response bias;
- ability to develop geographically granular estimates;
- ability to detect short-term trends in response to policies and changing conditions; and
- capacity for retrospective analysis for other drugs and metabolites, using stored samples.

---

[27] The other three Pathfinder initiatives include *Transition to a low carbon economy*, *Measuring the growth in international visitors to Canada* and the *Canadian Housing Statistics Program*.

Data from municipal wastewater can provide high-quality baseline information at the city level, helping to understand regional differences in consumption and its implications.

Once cannabis is legalized, these data may provide an indication of the size of the underground economy by subtracting consumption from legal sources from total consumption. Given the recurring and timely nature of these data, municipalities and health authorities will be able to assess the impact of cannabis legalization first as it initially occurs, and, second, as governments make legal various cannabis products such as edibles, concentrates and health and wellness products.

As a starting point, Statistics Canada is partnering with a number of municipalities to obtain daily samples, which will then be shipped to the accredited laboratory where they will be tested The test results will then be sent on to Statistics Canada who, finally, will run the results through its model to calculate population-level estimates of consumption and disseminate the results to Canadians.

Owing to the normal uncertainty associated with chemical sampling and analysis, and the assumptions that go into transforming drug concentrations in wastewater into population-level consumption levels, these estimates come with a fairly large degree of uncertainty. They will be compared to other information on consumption, obtained principally from health and drug use monitoring surveys of the population. While the estimates of population consumption based on wastewater will involve some uncertainty, it is expected that they will provide, at fairly frequent intervals, a clear indication of time trends in cannabis and opioid use. This will serve to complement and validate other sources.

"StatsCannabis": Using crowdsourcing to measure the price of cannabis

On January 25th, 2018 Statistics Canada launched a crowdsourcing web application that allows Canadians to directly and anonymously provide information regarding their purchases of cannabis. The purpose of the project to collect information to allow the estimation of the monthly price of illegal cannabis in Canada prior to and after the legalization of marijuana for non-medical purposes.

During the development of the StatsCannabis collection tool, emphasis was placed on a style that aimed to optimize the likelihood of a visitor submitting information. This included minimizing details in the application to focus on key collection fields, developing the web application with handheld devices in mind and structuring questions to be easily understood.

The application was designed to produce minimal response burden and provide the respondent with interesting information: average prices across Canada compared to their reported price. Designing anonymity directly within the collection tool also enabled the agency to easily disseminate the data at a micro-level. The data are downloadable directly from the crowdsourcing application.

The following process illustrates the interface for the collection instrument currently in use to collect information on cannabis prices from visitors to the website.
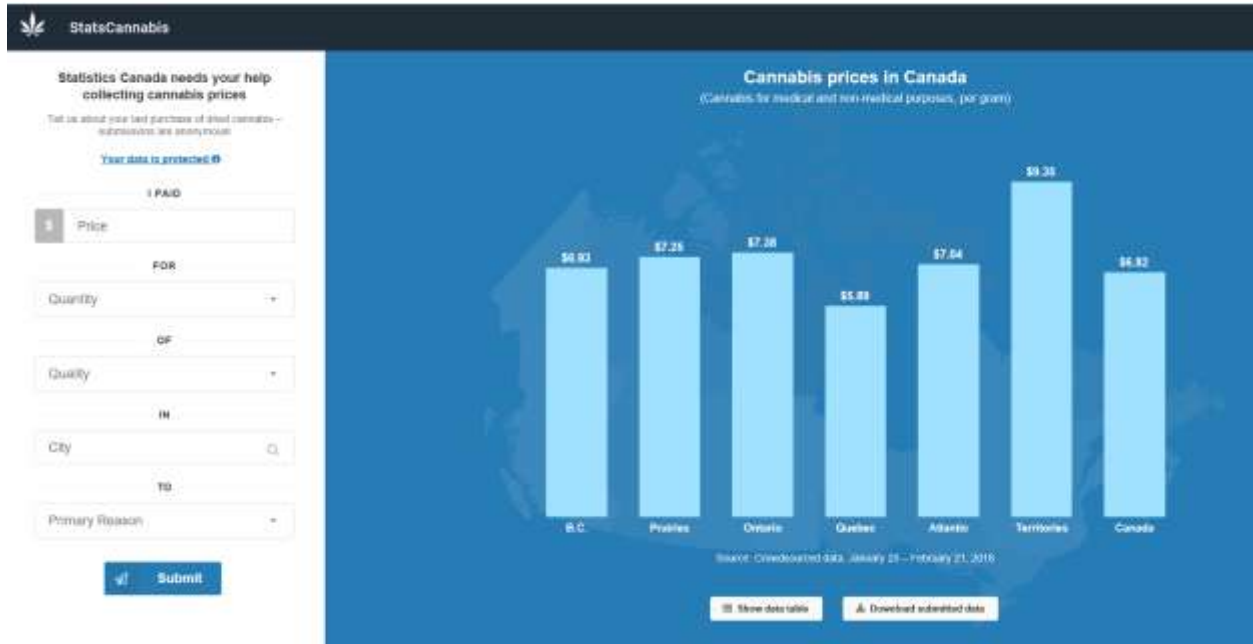
StatsCannabis 1ˢᵗ page– The initial screen requests the price of cannabis from the respondent, displaying data aggregated from all previous submissions. The intent of the messaging is to engage the respondent as a partner and stakeholder in the collection activity and reinforce that other respondents are submitting data and remaining anonymous.

The information collected includes the price paid for a determinate quality. Price is collected separately from quantity since user testing indicated it was easier for respondents to provide expenditure (price) and quantity than unit price together, especially for smaller volumes. For quantity, respondents select from a drop down list of common quantities or have the option to provide their own.

Other information collected includes quality, city of purchase and primary reason for use. Quality is reported as low, medium or high. While perhaps simplistic, reported data correlates to what would be expected. City of purchase provides a geographic dimension. Users type in the city name and select from a drop down menu. Options for purpose include recreational (non-medical), to medicate with medical document, and to medicate without medical document. Only respondents selecting 'to medicate with medical document' are considered to be consuming legal product.

StatsCannabis 2nd Page: Once the respondent submits their information they are presented with their price per gram relative to the average of other posted prices by region. The average prices are edited by Statistics Canada from the crowdsourced data. Respondents are then asked follow up questions related to usage and consumption, the application specifying daily, weekly, monthly or annual use and selecting average monthly consumption from a drop down, or specifying an amount. This provides data to estimate volume of consumption via the application.

While the approach is neither scientific nor easily sustainable from a collection perspective, it does have a number of statistical and economic properties that one would associate with high quality data. Depending on the envisioned use of the data collected, this crowdsourcing approach presents a potentially cost effective and efficient means to gather that informational for official statistics.

Some preliminary results: cannabis prices 2018

Based on the information submitted from January 25 to February 28, 2018 the average price of cannabis was $6.83 per gram. This estimate is based on 17,139 responses whose prices fell between $2 per gram and $20 per gram; prices outside this range were treated as outliers. The $6.83 per gram price estimate is consistent with the estimate of approximately $7.50 derived by Statistics Canada for 2017 using various sources of information including prices extracted from licenced and unlicensed producer websites.

Analysing the data showed that prices varied across regions, with prices in Quebec and New Brunswick below the national average and prices in all other provinces and territories above the national average. Average prices were particularly high in the territories where transportation costs may be relatively larger

The data also shows that, the greater the volume of cannabis purchased, the lower the implicit per gram price is. The average price reported by respondents who purchased 1 gram was $8.36 per gram, whereas it was $5.48 for those purchasing 28 grams – illustrating price discounts for bulk purchases, which is consistent with what could be expected.

26

Chart 3 - Average prices by quantity purchased, February 2018
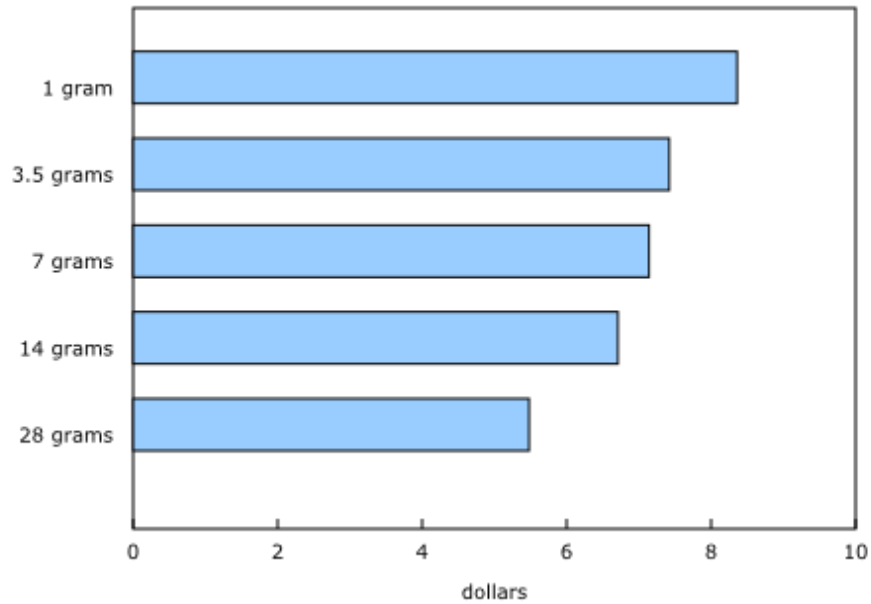
Price differentials according to type of *use* were also found. The average price of cannabis used for medical purposes with a medical document was $7.21, whereas the average price of cannabis used for non-medical purposes was $6.78. This could be an indication that medical users were more concerned about quality and safety and that they paid a higher prices for quality and safety.

Respondents reported that, in the vast majority of cases, they consumed cannabis for non-medical purposes, even though consumption for non-medical purposes is illegal. Around two-thirds (63%) of respondents reported using cannabis for non-medical purposes. Interestingly, more individuals reported consuming cannabis for medical purposes without a document (26%)—that is, illegally—than with a document (10%).

The individuals who reported daily use indicated they consume an estimated 28.0 grams of cannabis per month, about one gram per day. Individuals who consume less than once per day indicated they consume 6.3 grams of cannabis per month.

The prices paid by individuals reporting daily use was $6.54, while the price paid by individuals reporting monthly use was $7.32. The lower price paid by daily users may be an indication they are purchasing larger volumes which have a price discount, which is again consistent with what could be expected.

The majority of respondents (61%) indicated purchasing high quality cannabis. Very few respondents indicated they were purchasing low quality cannabis. The results were consistent from one province to another.

7. Conclusions and next steps

While the journey is not yet over, experience to date with the legalization of cannabis has presented Statistics Canada with both challenges and opportunities in a number of dimensions. From a statistical measurement perspective we have mobilized across the organization and with regulatory partners to make optimal use of available information and to develop the infrastructure and collection vehicles required to respond to information needs. This has afforded us the opportunity to step into non-traditional measurement techniques, such as crowdsourcing and wastewater analysis, which have been demonstrated as viable alternatives or compliments to traditional survey measures, given quality risks from declining response rates.

From a national accounts perspective we have developed relevant measures of illegal underground cannabis activity extending back in time, positioning us to understand economic impacts throughout the transition to legalization and beyond. From a communication and dissemination perspective we have stepped into unprecedented territory in developing innovative tools, such as the Cannabis Stats Hub, to engage the public and the media.

With the official coming into force date for Bill C-45, the *Cannabis Act*, now confirmed for October 17, 2018, we are in a position to finalize plans for implementation in the core Canadian national accounts. While the Cannabis Economic Account will serve as a mechanism to populate the required information in the core SNA, we are assessing the extent to which GDP will be impacted, as some hidden activity related to the production and distribution of cannabis is likely already captured in other industries in existing core measures.

It is expected that the underground market will persist for a period of time and, given important policy objectives to reduce illegal cannabis activity, we will continue to track the legal and illegal non-medical markets separately. This will be accomplished via analysis of supply and demand, using the quarterly National Cannabis Survey and a variety of other sources. Since the availability of authorized retailers will be restricted initially, we will monitor available outlets and the number of Canadians dwelling within an accessible radius (for example, 20-30km) via a geomatics application. This will help inform the analysis over the transition, for example, to explain why per capita consumption differs across regions post legalization.

First official estimates for the cannabis industry (both legal and illegal) will be published in core estimates with the release of monthly real GDP by industry for November at the end of January, 2019. These will be followed by the fourth quarter income and expenditure accounts released at the end of February, and eventually by new Supply and Use benchmarks and regional accounts in the subsequent production cycle.

References

Bouchard, M (2008). Towards a realistic method to estimate cannabis production in industrialized countries. *Contemporary Drug Problems*, 35.

Donegan, I and Smith, P. 2018. *A snapshot of licensed cannabis producers.*. Latest Developments in the Canadian System of National Accounts. Statistics Canada Catalogue no. 13 605-X. Ottawa, Ontario. Available at: https://www150.statcan.gc.ca/n1/pub/13-605-x/2018001/article/54961-eng.htm (accessed July 23rd 2018).

Easton, S. (2004). Marijuana Growth in British Columbia. *Public Policy Sources*, 74.

Health Canada. *Understanding the New Access to Cannabis for Medical Purposes*

Regulations. Available at: https://www.canada.ca/en/health-canada/services/publications/drugs-health-products/understanding-new-access-to-cannabis-formedical-purposes-regulations.html. (accessed July 23rd 2018).

Health Canada. *Procedures for Accessing Cannabis for Medical Purposes from a Licensed Producer.* Available at: https://www.canada.ca/en/health-canada/services/drugs-health-products/medical-use-marijuana/procedures-accessing-cannabis-medicalpurposes-licensed-producer.html. (accessed July 23rd 2018).

Health Canada. *Understanding the New Access to Cannabis for Medical Purposes Regulations*. Available at: https://www.canada.ca/en/health-canada/services/publications/drugs-health-products/understanding-new-access-to-cannabis-formedical-purposes-regulations.html. (accessed July 23rd 2018).

Health Canada. *Licensed Producers Market Data*. Available at: https://www.canada.ca/en/health-canada/services/drugs-health-products/medical-use-marijuana/licenced-producers/market-data.html. (accessed July 23rd 2018)

Library of Parliament. *Medical Marijuana:A Timeline.* Available at: https://lop.parl.ca/Content/LOP/ResearchPublications/tips/tip108-e.htm. (accessed July 23rd 2018).

Office of the Parliamentary Budget Officer (PBO). 2016*. Legalized Cannabis: Fiscal Considerations*. Ottawa, ON

Mawani, F., Maslov, A. and A. Lawrence. 2017. Measuring Illicit Cannabis Seizures in Canada. Research Report 2017-R002. Public Safety Canada. Ottawa. ON.

Measuring Canada's cannabis economy. The Economist. Available at: https://www.economist.com/the-americas/2018/01/11/measureing-canadas-cannabis-economy. (accessed July 23rd 2018)

Rotermann M, and Macdonald, R. 2017. *Experimental estimates of cannabis consumption in Canada, 1960 to 2015*. Economic Insights. Available from https://www150statcan.gc.ca/n1/pub/11-626x2017077-eng.htm

Rotermann, M and Macdonald, R. 2018. *Constructing Historical Cannabis Consumption Volume Estimates for Canada, 1960 to 2015.* Statistics Canada Catalogue no. 11-633-X. Ottawa, Ontario. Available at https://www150.statcan.gc.ca/n1/pub/11-633-x/11-633-x2018015-eng.htm (accessed July 23rd 2018).

Statistics Canada. n.d. *National Cannabis Survey,, Detailed information for second quarter 2018.* Last updated May 15, 2018. Available at: http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5262 (accessed July 23rd 2018).

Statistics Canada. 2017. *Preparing the statistical system for the legalization of cannabis*. Latest Developments in the Canadian System of National Accounts. Statistics Canada Catalogue no. 13 605-X. Ottawa, Ontario. Available at: http://www.statcan.gc.ca/pub/13-605-x/2017001/article/14840-eng.htm(accessed July 23rd 2018).

Statistics Canada. 2018. *Cannabis Stats Hub.* Available at: https://www150.statcan.gc.ca/n1/pub/13-610-x/cannabis-eng.htm (accessed July 23th 2018).

Statistics Canada. 2018. *Classifying Cannabis in the Canadian Statistical System.* Available at: http://www.statcan.gc.ca/eng/subjects/standard/cannabis/cannabis (accessed July 23th 2018).

Statistics Canada. 2018. *StatsCannabis.* Available at: https://surveys-enquetes.statcan.gc.ca/cannabis/ (accessed July 23th 2018).

Statistics Canada. 2018. *Using municipal wastewater to measure Canadians' consumption of cannabis and opiods*. Latest Developments in the Canadian System of National Accounts.Statistics Canada Catalogue no. 13 605-X. Ottawa, Ontario. Available at:https://www150.statcan.gc.ca/n1/pub/13-605-x/2018001/article/54922-eng.htm (accessed July 23rd 2018).

Statistics Canada. 2018, January 25. Cannabis Economic Account, 1961 to 2017. *The Daily*. Available at https://www150.statcan.gc.ca/n1/daily-quotidien/180125/dq180125c-eng.htm (accessed July 23rd 2018).

Statistics Canada. 2018, February 2. StatsCannabis data availability: Crowdsourced cannabis prices from January 25 to January 31, 2018. *The Daily*. Available at https://www150.statcan.gc.ca/n1/daily-quotidien/180202/dq180202a-eng.htm (accessed July 23rd 2018).

Statistics Canada. 2018, March 9. StatsCannabis data availability: Crowdsourced cannabis prices, February 2018. *The Daily*. Available at https://www150.statcan.gc.ca/n1/daily-quotidien/180309/dq180309e-eng.htm (accessed July 23rd 2018).

Statistics Canada. 2018, April 13. StatsCannabis data availability: Crowdsourced cannabis prices, March 2018. *The Daily*. Available at https://www150.statcan.gc.ca/n1/daily-quotidien/180413/dq180413c-eng.htm (accessed July 23rd 2018).

Statistics Canada. 2018, April 30. Provincial and Territorial Cannabis Economic Accounts, 2017. *The Daily*. Available at https://www150.statcan.gc.ca/n1/daily-quotidien/180430/dq180430b-eng.htm (accessed July 23rd 2018).

Statistics Canada. 2018, July 6. StatsCannabis data availability: Crowdsourced cannabis prices, second quarter 2018. *The Daily*. Available at https://www150.statcan.gc.ca/n1/daily-quotidien/180706/dq180706c-eng.htm (accessed July 23rd 2018).

Tebrake, J. 2017. *A cannabis economic account – The framework.* Latest Developments in the Canadian Economic Accounts. Statistics Canada Catalogue no. 13-605-X. Ottawa, Ontario. Available at http://www.statcan.gc.ca/pub/13-605-x/2017001/article/54881-eng.htm (accessed July 23rd 2018).