



A Baseline Review and Assessment of Adult and Emerging Adult Cannabis Use: *High-Level Findings from The International Cannabis Policy Study (2018-2019) and Literature Overview*

November 2020

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Purpose

This report has been prepared in response to the enabling legislation, M.G.L Ch. 94G Sec. 17a (iii), which states: *“The commission shall develop a research agenda in order to understand the social and economic trends of marijuana in the commonwealth, to inform future decisions that would aid in the closure of the illicit marketplace and to inform the commission on the public health impacts of marijuana.”*

One of the research agenda priority items includes:

- (1) patterns of use, methods of consumption, sources of purchase, and general perceptions of marijuana among minors, among college and university students, and among adults. [For a full assessment of youth (“minors”), please see [Doonan SM., Hamilton, JR., Johnson, JK \(2019, September\). A Baseline Review and Assessment of Cannabis Use and Youth: Literature Review and Preliminary Data in Massachusetts. Boston, MA: Massachusetts Cannabis Control Commission](#)].

In addition, the enabling legislation states that the Commission shall incorporate available data, annually report on the results of its research, and make recommendations for further research or policy changes.

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Main Findings

International Cannabis Policy Study (Massachusetts)

- In 2019, the International Cannabis Policy Study (ICPS) found that approximately 35% of Massachusetts respondents 16-65 years old reported past year cannabis use. Fourteen percent of respondents reported daily or near daily use.
- From 2018 to 2019, there was no change to prevalence of past cannabis use among Massachusetts adult respondents. However, use changes are likely to lag, thus cautious interpretation is necessary. Current (preliminary) findings may not reflect long-term changes in use.
- From 2018 to 2019, there were several changes in cannabis use modes among Massachusetts respondents that reported past year cannabis use. In 2019, a greater percent of respondents reported use of cannabis edibles, topical ointments (such as skin lotion), and oral cannabis oils (such as orally ingested drops and capsules). A lower percent of respondents reported cannabis use through dried herb (smoked or vaped), ($p < .05$).
- From 2018 to 2019, a greater percent of participants reported obtaining cannabis from a store, co-operative, or dispensary ($p < .001$). However, there were no observed changes in the percent of past-year users that report obtaining cannabis from a non-licensed dealer (in person).
- In 2019, 16% of respondents that used cannabis in the past year reported that they drove a vehicle within two hours of cannabis use. Among all respondents, 21% reported riding with a driver who used cannabis in the past two hours. There were no significant changes in either behavior between 2018 and 2019.
- Continuing to monitor varying adult cannabis use trends is critical as the Massachusetts cannabis industry matures. Data monitoring may assist in preventing potential adverse clinical or public health events, as well as provide legislators and regulators evidence-based data for future policy and/or regulatory change(s).
- ***Please note:** This report is limited to aggregate high-level findings. In future work we plan to examine any differences across race, ethnicity, gender, and age groups to better understand trend variations between cohorts.

I. Brief History of Cannabis Policies

Cannabis has been used for religious, recreational, and therapeutic purposes for thousands of years and is currently the most frequently cultivated, trafficked, and abused illicit substance (“drug”) worldwide.¹⁻⁵ In the United States (U.S.), cannabis cultivation and use were legal under federal and state policies for most of American history. An increase in cannabis use from 1910-1920, coupled with often racially motivated changes in attitudes toward cannabis use, led twenty-nine states, including Massachusetts, to pass policies prohibiting the possession or sale of cannabis.^{2,6,7}

In 1970, the Federal Controlled Substance Act (CSA) replaced the Marihuana Tax Act of 1937 and placed cannabis (“marijuana”) as a Schedule 1 drug, the most restrictive ranking of illicit drugs. Despite increasing stringency of federal cannabis policies over time, the recreational use of cannabis increased. In 1971, President Richard Nixon declared a “war on drugs” to combat harmful substance use on the supply and demand sides, which focused on criminal justice enforcement and punishment for drug offenses that disproportionately impacted Black, Hispanic/Latinx, and other communities of color.

Currently in the CSA and under the U.S. Drug Enforcement Agency (DEA) jurisdiction, cannabis remains classified as a Schedule 1 drug, contending that it has: (1) a high potential for abuse, (2) no current accepted medical use in the U.S., and (3) a lack of accepted safety for use under medical supervision.^{8,9}

Moving Toward Legalization

Movement toward cannabis legalization has occurred on a state-by-state basis. The first wave of cannabis legalization was decriminalization, which replaced criminal sanctions for possession and small-scale distribution of cannabis with civil fines.¹⁰ Since 1972, 26 states and the District of Columbia (D.C.) have enacted policies decriminalizing small amounts of cannabis.

Medicinal marijuana policies followed, allowing access to and use of cannabis for specified medical purposes. Since 1996, 33 states, D.C., Guam, and Puerto Rico have enacted varying policies permitting comprehensive medicinal cannabis programs.

Adult-use legalization policies allow cannabis use by adults in certain settings and may allow for retail stores. As of October 2020, eleven states and D.C. have enacted varying policies permitting small amounts of cannabis for non-medical adult-use for those 21 years-old or older (“21≤”) since 2012.¹¹

Massachusetts

Massachusetts enacted and implemented three waves of cannabis legalization. All waves of Massachusetts cannabis legalization were enacted via ballot initiatives: cannabis decriminalization in 2008 with Question 2, “The Sensible Marijuana Policy Initiative,” medical cannabis in 2012 with Question 3, “An Initiative Petition for a Law for the Humanitarian

Medical Use of Marijuana;” and non-medical, adult-use cannabis legalization in 2016 with Question 4, “Massachusetts Legalization, Regulation and Taxation of Marijuana Initiative”.

II. Data Source

This study uses the International Cannabis Policy Study (ICPS) data to assess Massachusetts adults’ (aged 21≤) and emerging adults’ (aged 16-20) cannabis use and use patterns prior to and just after adult-use retail store implementation. Where relevant, we include results from the Behavioral Risk Factor Surveillance System (BRFSS)¹ survey, a surveillance system survey assessing varying health indicators in the adult Massachusetts population, including substance use, collected by the Massachusetts Department of Public Health (DPH).

1. International Cannabis Policy Study: *Massachusetts Subsample*

The ICPS is designed to examine the impacts of cannabis policy on public health in multiple domains.¹² The project started in 2018 and includes annual population-based surveys in Canada and the U.S. Data in this report includes results from wave 1 (2018) and wave 2 (2019) among Massachusetts participants only. As in all research, this study is subject to limitations, including social desirability bias and bias inherent in longitudinal designs, (see Hammond et al. 2020 for further discussion). However, the ICPS adds critical metrics to repeated surveying, including but not limited to, its comprehensive approach to understand specific cannabis patterns, trends, and perceptions across a range of cohorts and market indicators.¹²

Participants between 16-65 years old were recruited through the Nielsen Consumer Insights Global Panel. The 2018 sample included 1,143 Massachusetts respondents (sampled between Aug 27-Oct 7, 2018). The 2019 sample included 2,476 Massachusetts respondents (sampled between Sept 13-Oct 31, 2019). The ICPS study team used post-stratification survey weights created using age-by-sex-by-state, education, and age-by-smoking status groups. The report estimates are weighted.

For purposes of this report, only high-level findings from waves 1 and 2 are included. This report does not intend to provide a comprehensive assessment of all results (i.e. results by cohort are not shown). However, in future work, the Commission plans to provide a closer look at findings across cohorts, including by race and ethnicity, gender, age, and other key demographic characteristics. This report will include a scoping review of social equity.

For more information about the ICPS, please see: <http://cannabisproject.ca/>.

¹The Behavioral Risk Factor Surveillance System (BRFSS) is an annual phone survey that examines health and health behaviors of adults 18 years-old and older. The survey contains core questions that are asked nationally and state-added questions which vary between states.

III. Methods

The Cannabis Control Commission procured the ICPS data for the subset of Massachusetts respondents in study wave 1 (2018) and wave 2 (2019). This report includes key results for the Massachusetts subsamples, 2018-2019. We include prevalence findings from BRFSS in results discussion. As we were unable to procure BRFSS data currently, we did not conduct any data analyses on the BRFSS internally. The data we report comes directly from other public reporting.²

The ICPS survey is a prospective cohort study and is subject to various unique and common limitations. All data included in this report is weighted using age-by-sex-by-state, education and age-by-smoking status groups. The ICPS study team conducted chi-square tests of independence to assess for significant differences between 2018 and 2019 results. Only high-level results are included in this report; However, future analyses will include outcome stratification by race, ethnicity, gender, and age.

[See *Section VI. Research Gaps and Limitations* for further discussion on limitations].

² BRFSS data can be found here: <https://www.mass.gov/lists/brfss-statewide-reports-and-publications#2018->. All BRFSS data referenced in findings sections is from 2018 report: <https://www.mass.gov/doc/a-profile-of-health-among-massachusetts-adults-2018/download>

IV. Results

Cannabis Use Frequency

Participants report cannabis use history and use frequency in the ICPS. Among Massachusetts adults (21≤),³ approximately 30% report no lifetime use, 33% report last use was more than one year ago, 11% report last use in the last year, 5% report last use in the last month, 6% report use in the last week, and 14% report daily use.

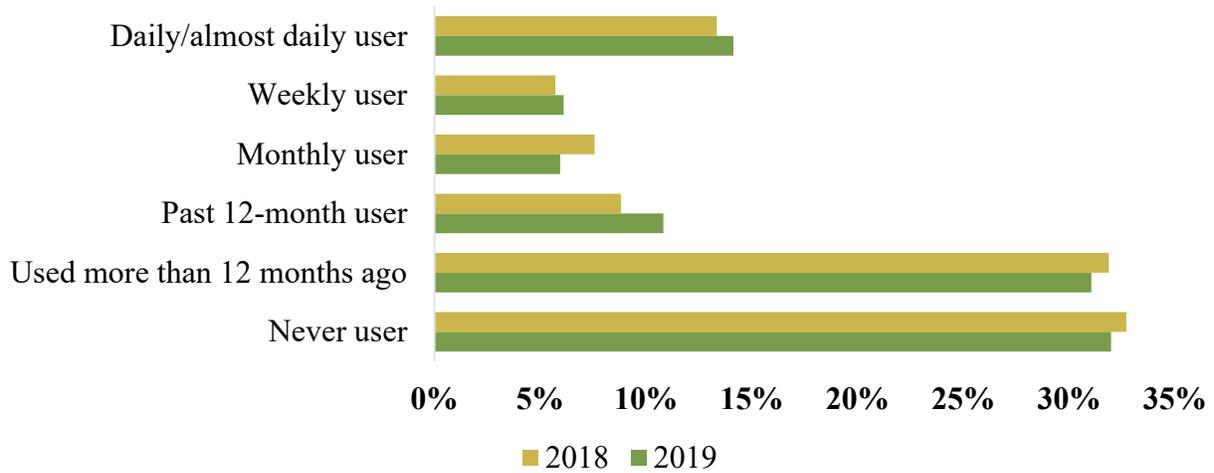
Among Massachusetts emerging adults (16-20), approximately 53% report no lifetime use, 12% report last use more than one year ago, 8% report last use in the last year, 10% report last use in the last month, 5% report use in the last week, and 13% report daily use.

There is no significant difference in cannabis use frequency from 2018 to 2019 among Massachusetts respondents in the aggregate. Approximately one third of respondents report no lifetime cannabis use (33% [2018], 32% [2019]). Another third report that their last cannabis use was more than one year ago (32%, 31%). Daily or almost daily cannabis users comprised between 13% (2018) to 14% (2019) of the sample.

Overall, approximately 35% (2018) and 37% (2019) of respondents report any cannabis use in the past year. For comparison, in 2018 the BRFSS survey found approximately 13% of adults (confidence interval [CI]:11.2-14.7) report nonmedical use of cannabis in the previous year. The ICPS use rates are in alignment with data collected as part of the Massachusetts Public Awareness Campaign (31% [past year use]) and the Marijuana Baseline Health Study (21.1% [past month use]), suggesting that BRFSS cannabis use data in 2018 may be under-reported.^{13,14}

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Graph IV.1. Cannabis Use Frequency: International Cannabis Policy Study MA Sample, 2018-2019, (no significant differences)



Note: Past 12-month user indicates those who have used in the past 12 months but not more recently.

Table IV.1. Cannabis Use Frequency: International Cannabis Policy Study MA Sample, 2018-2019, (no significant differences)

Cannabis Use Status	Wave 1 Weighted Frequency (Percent)	Wave 2 Weighted Frequency (Percent)	P value
Never user	373.69 (32.69%)	791.52 (31.97%)	p=0.58
Used more than 12 months ago	364.28 (31.87%)	768.38 (31.03%)	
Past 12-month user	100.75 (8.81%)	267.77 (10.81%)	
Monthly user	86.43 (7.56%)	147.07 (5.94%)	
Weekly user	65.42 (5.72%)	151.32 (6.11%)	
Daily/almost daily user	152.42 (13.34%)	349.94 (14.13%)	
Total	1,143 (100%)	2,476 (100%)	

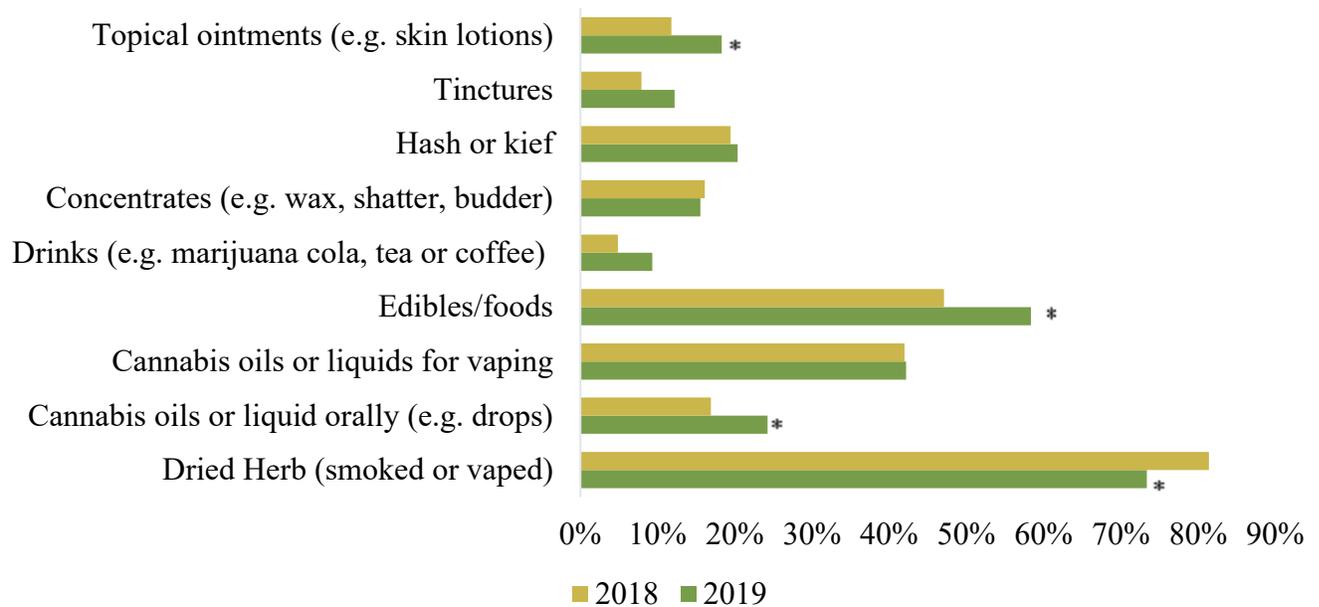
Modes of Cannabis Use

The ICPS asks participants to identify the modes (i.e. mechanisms of cannabis consumption) through which they have used cannabis in the past year. These questions are only asked to persons reporting past year cannabis use, not the entire sample. As participants may indicate all modes that apply, percentages do not sum to 100%.

Among all respondents in 2019, 73% of past year cannabis users report consumption of cannabis through dried herb (smoked or vaped cannabis). Approximately 58% of past-year cannabis users report cannabis edible use. Concentrates are the only mode of consumption that differed in percent of endorsement between the adult ($21\leq$) and the emerging adult (16-20) subsample. A greater percent of emerging adults with past year use report concentrate use as compared to adults.

Overall, several modes show significant changes between 2018 and 2019. Topical ointment cannabis use, such as skin lotions, increased from 12% to 18% ($p<.05$). Edible cannabis use increased from 47% to 58% ($p<.05$). Cannabis oils or liquids consumed orally, such as drops or capsules, increased from 17% to 24% ($p<.05$). Dried herb (smoked or vaped) cannabis use decreased from 81% to 73% ($p<.05$). All other modes of use did not show significant changes between 2018 and 2019. These trends may change as the Massachusetts cannabis market matures and saturates.

Graph IV.2. Mode of Cannabis Use: International Cannabis Policy Study MA Sample, 2018-2019



Notes: * p<.05, ** p<.01, *** p<.001

Table IV.2. Mode of Cannabis Use: International Cannabis Policy Study MA Sample, 2018-2019

Past Year Use by Mode	Wave 1 (n=330) Weighted Frequency (Percent)	Wave 2 (n=918) Weighted Frequency (Percent)	P value (n=124)
Dried Herb (smoked or vaped)	329.69 (81.40%)	671.92 (73.35%)	p=0.02
Cannabis oils or liquid orally (e.g. drops or capsules)	68.48 (16.91%)	221.93 (24.23%)	p=0.02
Cannabis oils or liquids for vaping	169.91 (41.95%)	386.18 (42.15%)	p=0.96
Edibles/foods	190.71 (47.09%)	534.55 (58.35%)	p=0.01
Drinks (e.g. marijuana cola, tea or coffee)	37.49 (4.86%)	112.47 (9.29%)	p=0.29
Concentrates (e.g. wax, shatter, budder)	65.20 (16.10%)	142.46 (15.55%)	p=0.86
Hash or kief	78.71 (19.43%)	186.49 (20.36%)	p=0.79
Tinctures	32.04 (7.91%)	111.61 (12.18%)	p=0.05
Topical ointments (e.g. skin lotions)	47.79 (11.80%)	167.72(18.31%)	p=0.02



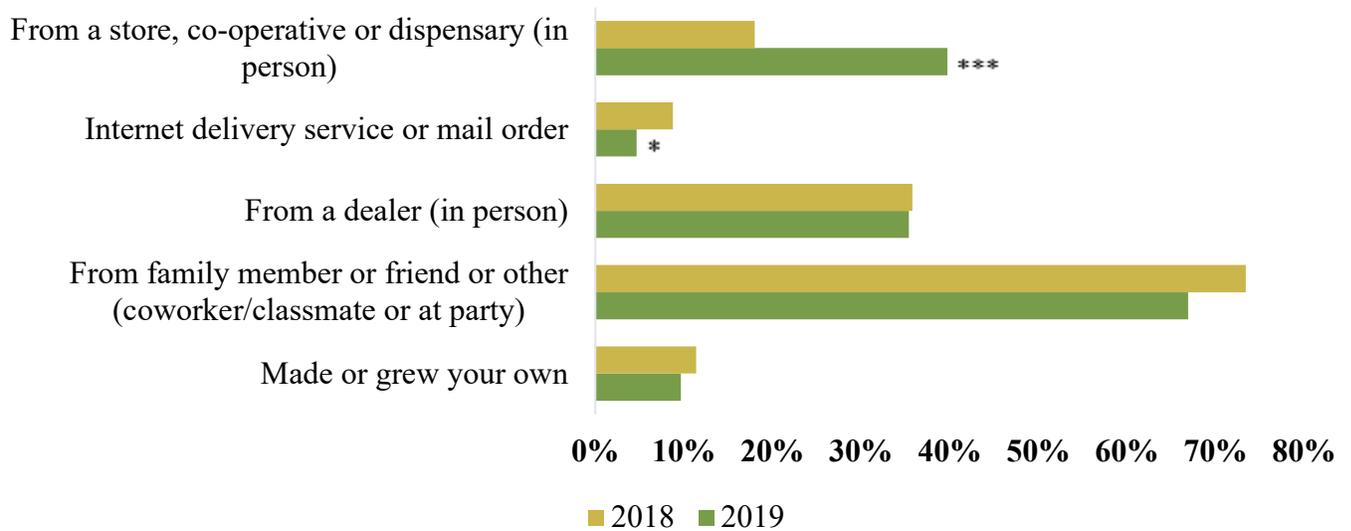
Source of Cannabis

The ICPS ask participants to report whether they have received cannabis from a list of potential sources in the past year. These questions are only asked to persons reporting past year cannabis use, not the entire sample. As participants may indicate all sources that apply, percentages do not sum to 100%.

In 2019, and in order of most prevalent, the three most frequent sources respondents' report obtaining cannabis from are: 1) one's family or friends (67%); 2) licensed store, co-operative, or dispensary (40%); and 3) a non-licensed dealer (in person) (35%). There are significant differences between adults (21 \leq) and emerging adults (16-20) in two sources. A greater percent of emerging adults endorse obtaining cannabis from a non-licensed dealer compared to adults, while a greater percent of adults endorse obtaining cannabis from a licensed store, co-operative, or dispensary compared to emerging adults.

Several sources of cannabis show significant changes between 2018 and 2019. Obtaining cannabis from a store, co-operative, or an in-person dispensary increased from 18% to 40% ($p < .001$). Obtaining cannabis through an internet delivery service or mail order decreased from 9% to 5% ($p < .05$). Other sources of cannabis, including obtaining from a non-licensed dealer in person, family member or friend, or one's own home-grow, did not show any significant change.

Graph IV.3. Cannabis Source: International Cannabis Policy Study MA Sample, 2018-2019



Notes: * p<.05, ** p<.01, *** p<.001

Table IV.3. Cannabis Source: International Cannabis Policy Study MA Sample, 2018-2019

Source of Cannabis	Wave 1 (n=330) Weighted Frequency (Percent)	Wave 2 (n=918) Weighted Frequency (Percent)	P value (n=1248)
Made or grew your own	46.13 (11.39%)	88.57 (9.67%)	p=0.51
From family member or friend or other (coworker/classmate or at party)	297.40 (73.43%)	613.13 (66.93%)	p=0.12
From a dealer (in person)	144.95 (35.79%)	324.17 (35.39%)	p=0.92
Internet delivery service or mail order	35.53 (8.77%)	42.78 (4.67%)	p=0.03
From a store, co-operative or dispensary (in person)	72.84 (17.98%)	364.00 (39.73%)	p<.001

Ease of Cannabis Access

The ICPS asks participants to report how easy or difficult it is (or how easy or difficult it would be) to access cannabis. These questions are asked to all survey respondents and participants may only select one answer.

There were no statistically significant differences between ease of access in the emerging adult (16-20) compared to the adult (21≤) cohort in 2019.

In 2019, 36% of respondents report that cannabis was very easy to access, while another 31% report that cannabis was fairly easy to obtain. In 2018, 24% of respondents reported cannabis was very easy to access, while 31% reported it was fairly easy to obtain.

A test of statistically significant independence between groups, chi-square tests, show there are differences between ease of access in 2018 and 2019. However, testing examined overall distribution of answers rather than each answer individually. Therefore, the level of significance for each answer between 2018 and 2019 is unknown.

Graph IV.4. Ease of Cannabis Access: International Cannabis Policy Study MA Sample, 2018-2019, (p<.001)

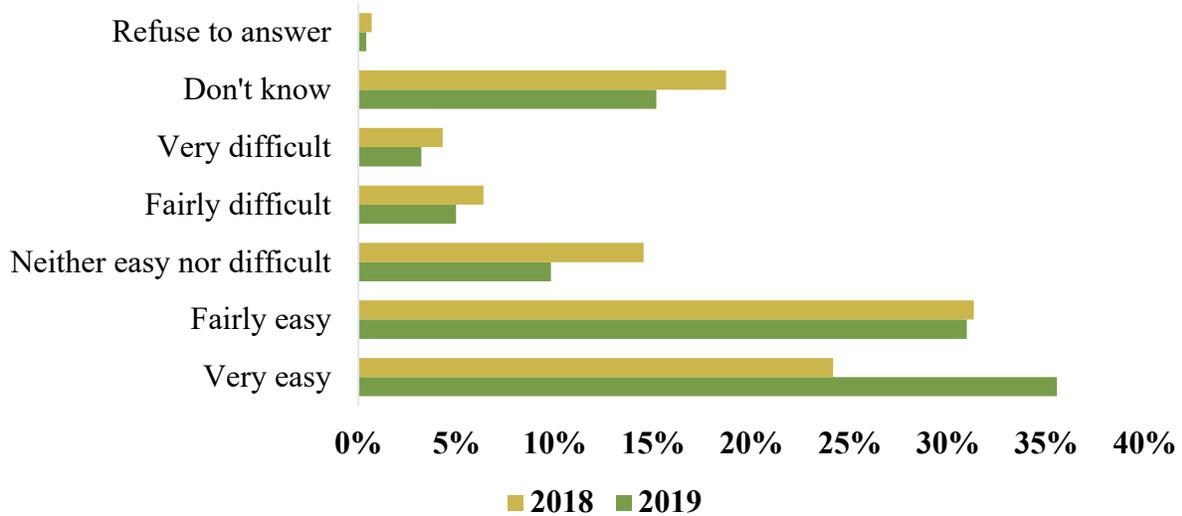


Table IV.4. Ease of Cannabis Access: International Cannabis Policy Study MA Sample, 2018-2019, (p<.001)

How Easy To Access Cannabis	Wave 1 (n=1,143) Weighted Frequency (Percent)	Wave 2 (n=2,476) Weighted Frequency (Percent)	P value (n=3,619)
Very easy	276.04 (24.15%)	879.66 (35.53%)	p<.001
Fairly easy	357.88 (31.31%)	766.47 (30.96%)	
Neither easy nor difficult	165.78 (14.50%)	242.49 (9.79%)	
Fairly difficult	72.68 (6.36%)	123.01 (4.97%)	
Very difficult	49.00 (4.29%)	79.22 (3.20%)	
Don't know	213.86 (18.71%)	375.39 (15.16%)	
Refuse to answer	7.75 (0.68%)	9.77 (0.39%)	
Total	1,143.00 (100.00%)	2,476.00 (100.00%)	

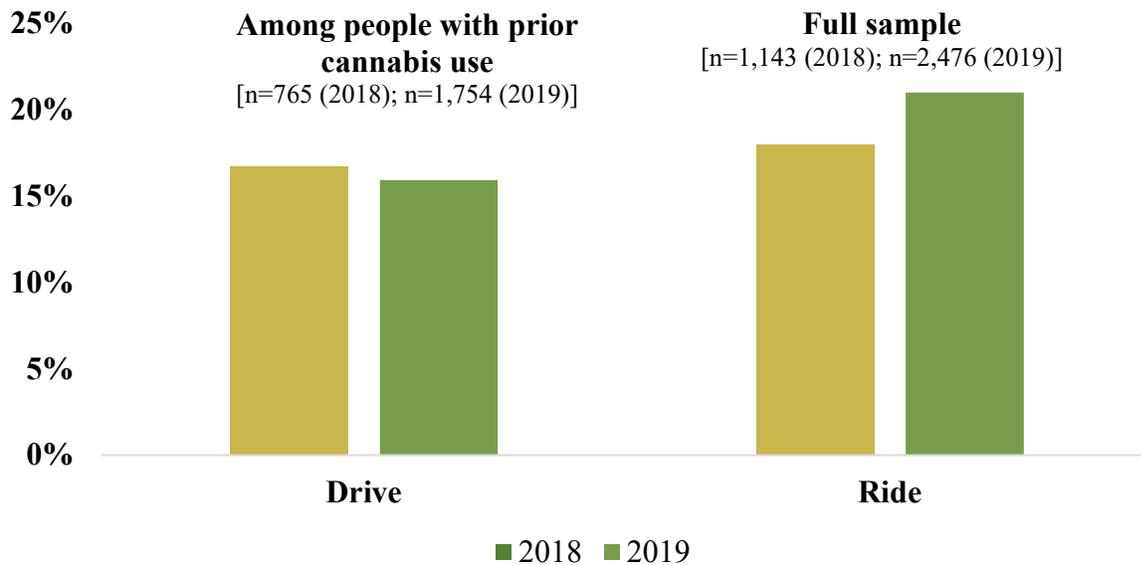
Driving and Riding Behaviors

The ICPS both asks participants to report: 1) whether they have driven a vehicle [e.g., car, snowmobile, motor boat, or an off-road vehicle (ATV)] within two hours after using cannabis; and 2) whether they have ridden as a passenger in a vehicle driven by someone who had used cannabis in the past two hours. Driving after cannabis use is *only* asked to participants that report having ever used cannabis (lifetime use). Riding with a driver that recently used cannabis is asked to *all* respondents, not a subsample.

In 2019, 16% of respondents that indicated previous cannabis use also report driving a vehicle within two hours of using cannabis. Among all respondents, 21% report riding as a passenger in a vehicle driven by a person who had used cannabis in the past two hours. Rates of potentially unsafe driving and riding behaviors in the last year were similar among adults (21 \leq) compared to the emerging adult (16-20) subsample.

Significance testing show no differences between the percent of people reporting potentially risky driving and riding behaviors between 2018 and 2019.

Graph IV.5. Driving and Riding After Recent Cannabis Use: International Cannabis Policy Study MA Samples, Percent, 2018-2019, (no significant difference within driving or within riding)



Notes: Driving after use was *only* asked to participants that indicated prior cannabis use. Riding with a driver that had recently used cannabis was asked of *all* respondents.

Table IV.5. Driving and Riding After Recent Cannabis Use: International Cannabis Policy Study MA Samples, Frequency and Percent, 2018-2019

Driving Behavior Metric	Wave 1 (n=765) Weighted Frequency (Percent)	Wave 2 (n=1,754) Weighted Frequency (Percent)	P value
Driven vehicle within two hours of cannabis use in last year	128.82 (16.74%)	268.38 (15.93%)	0.4772
Riding Behavior Metric	Wave 1 (n=1,143) Weighted Frequency (Percent)	Wave 2 (n=2,476) Weighted Frequency (Percent)	P value
Rode as a passenger in a vehicle [e.g., car, snowmobile, motorboat, or an off-road vehicle (ATV)] driven by someone who had been using marijuana in the last 2 hours	200.67 (17.56%)	527.34 (21.30%)	0.30

Cannabis Perceptions

The ICPS asks participants whether they believe people generally approve or disapprove of cannabis. This question is asked to all participants and participants may only select one answer.

Significance testing show no differences between perceived approval or disapproval of cannabis between 2018 and 2019. In 2019, approximately 36% of the sample believe people approve or strongly approve of cannabis. Approximately 29% of the sample believe people disapprove or strongly disapprove of cannabis, while about 28% believe people neither approve nor disapprove. There were no statistically significant differences between adult (21≤) and emerging adult (16-20) subgroups.

Graph IV.6. Perceptions of Cannabis: International Cannabis Policy Study MA Sample, 2018-2019, (no significant difference)

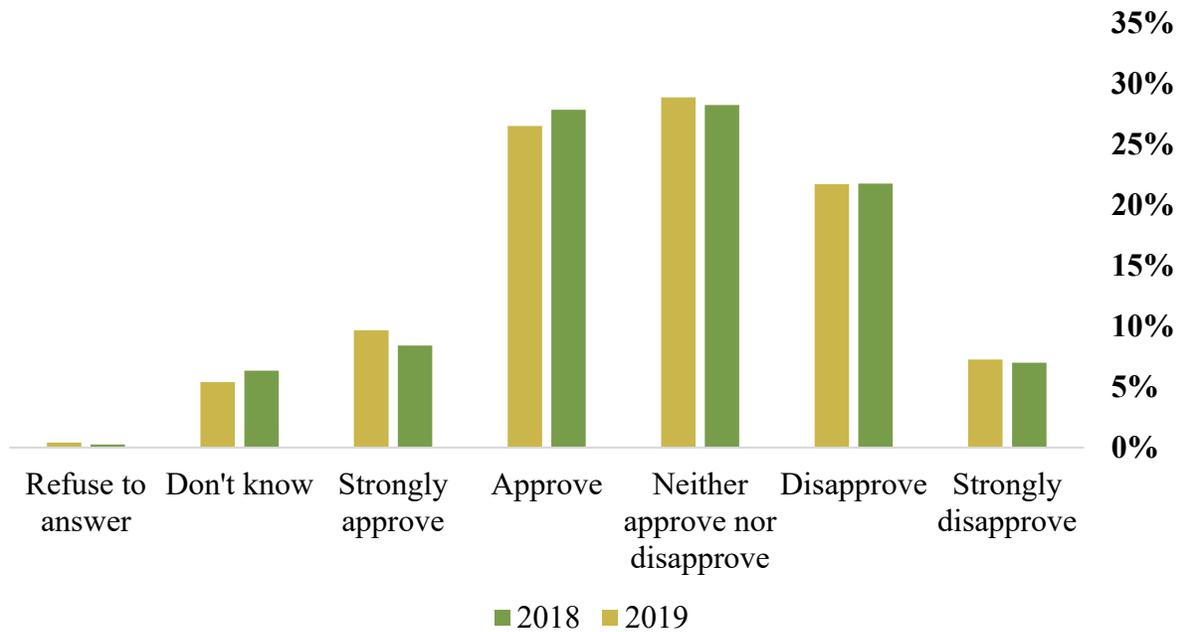


Table IV.6. Perceptions of Cannabis: International Cannabis Policy Study MA Sample, 2018-2019, (no significant difference)

Level of Perceived Approval	Wave 1 (n=1,143) Weighted Frequency (Percent)	Wave 2 (n=2,476) Weighted Frequency (Percent)	P value
Strongly disapprove	83.17 (7.28%)	173.75 (7.02%)	p=0.92
Disapprove	248.56 (21.75%)	539.51 (21.79%)	
Neither approve nor disapprove	330.45 (28.91%)	699.84 (28.27%)	
Approve	303.42 (26.55%)	690.68 (27.90%)	
Strongly approve	110.74 (9.69%)	208.50 (8.42%)	
Don't know	61.86 (5.41%)	157.15 (6.35%)	
Refuse to answer	4.80 (0.42%)	6.56 (0.26%)	
Total	1,143.00 (100.00%)	2,476.00 (100.00%)	p=0.92

V. Literature Overview

Methods

Targeted searches were conducted in May and September 2020 through GoogleScholar. The search terms included: “cannabis,” “marijuana,” “recreational,” “adult,” “legalization,” “impact,” “use pattern,” “trend.” For purposes of this overview, studies that only examine the impact of medical-use cannabis policies were excluded. Additionally, only studies that included impact of adult-use cannabis policies on adult (*i.e. aged 18 and over*) cannabis use were included. Bibliography and author reference libraries searches were also conducted. Articles with U.S. samples were prioritized, and the search was limited to English language articles.

[See [A Baseline Review and Assessment of Cannabis Use and Youth: Literature Review and Preliminary Data in Massachusetts](#) for data and literature reviews assessing the impact of cannabis policies on youth].

One high-quality review includes studies published between January 2005 and February 2019 (see Smart and Pacula 2019)¹⁵; therefore, we focus this literature review on studies published from 2019 through September 2020. The results of the identified review and additional recent studies are described below.

Findings

Adult-use cannabis legalization may increase adult cannabis use through a range of mechanisms, including removal of legal barriers, reduced price, and increased access and availability.¹⁶ Smart and Pacula 2019 reviewed the literature to examine the impacts of state medical and adult-use policies on substance use, including cannabis across age groups (2005-February 2019).¹⁵ Researchers identified one study that assessed the impact of adult-use cannabis legalization on adult cannabis use and found statistically insignificant results.¹⁷ Authors identified two studies that assessed the impact on college students.^{18,19} These studies found that adult-use legalization is associated with increased cannabis use among college students.^{18,19} Smart and Pacula 2019 also identified a study suggesting that the mode of cannabis use differs in states with legal adult-use cannabis. This study used an online survey of cannabis users (n=673) and found cannabis concentrate users had almost five times the odds of living in a state with legal adult-use cannabis.²⁰ However, researchers caution that the recency of adult-use policies greatly limit any assessment of outcomes, which typically lag¹⁵ behind policy enactment and implementation. Early studies are often limited by short follow-up timeframes during which an immature cannabis market may not reflect changes that occur after market maturity and saturation (e.g. projected price declines, increased access to legal retail stores). This lag could result in assessment of inadequate comparison group(s). Population changes (cross-sectional samples) may not reflect individual-level behavior changes (longitudinal samples). Further, studies may only include one state or may not assess policy heterogeneity (*i.e.* unique provisions and differences between state legalization policies).^{15,21,22} Additionally, these studies may not capture the impact of adult-use policy on use behaviors beyond prevalence (e.g. mode of use, use frequency).¹⁵

After this study period, we identified several studies which assess adult-use cannabis policies and use behaviors.²³⁻²⁸ However, the limitations outlined above remain consistent. Three studies find greater prevalence of cannabis use in adult samples after adult-use legalization or after the number of retail stores increased.^{23,24,28} Cerdá and colleagues used the National Survey on Drug Use and Health and find that past month cannabis use and past year cannabis use disorder (CUD) increase among adults 26≤, but did not find a change among younger “emerging adults” (aged 18-25) after adult-use legalization enactment.²⁵ However, a separate study finds increases in cannabis use among emerging adult cohorts of college students in states with adult-use cannabis.²⁶ When reviewed together, these results suggest that adult-use cannabis legalization is likely associated with greater adult cannabis use.

The cannabis policy landscape continues to change, mature, and saturate. Literature is still developing; therefore, continued data collection and monitoring is critical to better understand the varied and long-term impacts of cannabis legalization policies.

VI. Research Gaps and Limitations

Cannabis use outcomes and patterns vary. However, multiple outcomes (e.g. mode of use, frequency of use, amount of product used, source of product, cannabis use disorder) are less frequently captured in available survey data. Understanding the impacts of adult-use legalization enactment and implementation across these outcomes is key to understanding the varying impacts of legalization and differential impacts. For example, a finding that shows more people report using cannabis, but fewer people report using cannabis heavily is a different outcome from more cannabis users and a larger percent of heavy users (frequency and quantity of use). Therefore, nuanced measures of use behaviors provide important public health consideration for studying policy impacts. Future analysis should continue to identify changes to frequency and quantity of use, including number of times used per day, hours per day spent intoxicated, potency of product, delivery method, complementary or substitution effects with other substances; these all represent current gaps in the literature.

It is important for studies to evaluate policy heterogeneity, especially with provisions theoretically likely to increase access and use (e.g. allowance for home grow, adult-use retail stores, etc.). Policy heterogeneity and distinct policy differences at the state and/or municipal level may result in different impacts; research is only beginning to disentangle provision-specific effects.^{21,29} Further adding to complexity, policy impacts will likely vary across cohorts (e.g. age, gender, race/ethnicity, socioeconomic status).²⁹ Finally, while most research comes from early-legalizing states (i.e., Colorado, Washington), the extent to which findings are generalizable to other states is unknown.¹⁵ It is critical that studies assess and adjust for enactment versus full implementation and market saturation, which may have differential effects over time. Nonetheless, exciting new approaches, such as studies like the ICPS, are adding critical metrics to explore current gaps in our understanding of cannabis legalization for future assessments.

VII. Public Health Framework

There are inherent challenges to legalizing and regulating a formerly illicit substance.³⁰ Any implementation and regulation of cannabis policy(-ies) requires careful consideration to potential public health effects with special attention to vulnerable cohorts, such as adults with substance use disorders or emerging adults. Legalizing and regulating substances with dependence potential are often in juxtaposition to public health policy approaches since the minority of very heavy users (“dependent users”) account for the majority of consumption, which generates the greatest tax revenue³¹ as evidenced by the tobacco and alcohol industries.³² However, states can actively implement evidence-based policies to counter adverse public health and clinical outcomes.

The public health prevention model is an inclusive model targeting the overall health of the public at large rather than an individualized or small group prevention model. Nurse and Edmondson-Jones 2007 discuss the importance of a framework in public health delivery.³³ Authors state that a framework assists in providing shape, structure, clarity of purpose, and direction for a combination of constructs to improve the health of a population, which includes a complex combination of skills, methods, relationships, and interactions.³³ Public health frameworks work within varying systems that surround an individual and affect individuals’ behaviors, aiming to impact his/her choice(s) to partake in a behavior.³³⁻³⁶

Key Standards of Public Health

The 10 key standards of public health³³ are:

- Surveillance and assessment of the population’s health and well-being;
- Promoting and protecting the population’s health and well-being;
- Developing quality and risk management within an evaluative culture;
- Collaborative working for health;
- Developing health programs and services and reducing inequalities;
- Policy and strategy development and implementation;
- Working with and for communities;
- Strategic leadership for health;
- Research and development; and
- Ethically managing self, people, and others.

For the prevention of disease, the Centers for Disease Control and Prevention (CDC) published a framework outlining critical elements, which includes:

- Strong public health fundamental;
- High-impact intervention; and
- Sound health policies.

This public health framework is routinely applied to varying public health and public safety issues. In this framework, strong public health fundamentals refer to surveillance, detection, and investigation of the issue, such as cannabis dependency or misuse and associated behaviors. For

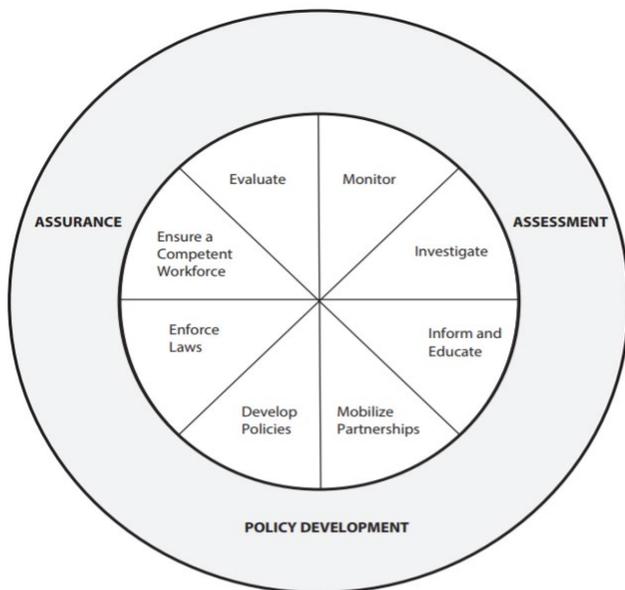
the Commonwealth, this framework would apply at both the local and state levels. High-impact interventions refer to focused efforts to prevent cannabis use within a short timeframe, such as identifying and validating new tools for prevention and expediting the broad use of validated interventions.

Sound health policies refer to developing and advancing policies to prevent, detect, and control harmful cannabis use behaviors, such as driving after cannabis use. Creating these sound health policies relies on ensuring sound scientific data to support evidence-based policies and working with local state and local public health and public safety departments to monitor, prevent, control, and respond to potential adverse events. These policy efforts are aimed at helping community leaders improve monitoring, local response and readiness, and educating the public.³⁷

Commonwealth of Massachusetts: Regulations and Public Health

In a 2015 article, Dr. Ghosh and colleagues at the Colorado Department of Public Health present a framework for cannabis legalization built on the core functions of public health, including: 1) assessing health issues through monitoring and investigation (“Assessment”); 2) developing policy through education and community partnerships (“Policy Development”); and 3) providing assurance through enforcement, a competent workforce, and evaluation (“Assurance”).

Figure VII.1. Public Health Framework for Legalized Cannabis: Colorado Department of Public Health and Environment, 2015.



[See Report, [A Baseline Review and Assessment of Cannabis Use and Youth: Literature Review and Preliminary Data in Massachusetts](#) Section IX. Public Health Framework: Commonwealth of Massachusetts: Regulations and Public Health (starting on page 93) for a comprehensive

outline of processes implemented by the Commonwealth of Massachusetts for domain included in Figure VII.1.]

VIII. Policy Considerations for the Commonwealth

Based on a preliminary review of the scope of adult and emerging adult cannabis use in Massachusetts and relevant literature, the Commission's Research Department, in consultation and collaboration with varying Massachusetts researchers and our internal departments, offer the following considerations to the Commonwealth regarding adult cannabis use.

Prevention

Education about cannabis policy, provisions, and safe use continues to be crucial to mitigate potential adverse effects, including: 1) increased unsafe cannabis use; 2) harmful home manufacturing; and 3) formulating medical perceptions of cannabis that are not supported by scientific evidence (e.g. common misperceptions that cannabis is harmless or that cannabis increases ability to concentrate on behaviors such as driving), as well as knowledge of Massachusetts-specific policies and provisions (e.g. legal age to purchase cannabis in a licensed retail store, unlawful to cross state lines if in possession of cannabis, etc.).

Consideration 1: The Commission continues to support and seek funding for continuing the Public Awareness Campaign started with the Department of Public Health. If funded, the Commission should consider a focus on policy education, youth prevention, and harm mitigation with revenue raised by cannabis excise taxes. Pre-and-post survey assessments of the public awareness campaign would be used to evaluate the campaign and make changes.

[See Report (1) [*A Baseline Review and Assessment of Cannabis Use and Youth: Literature Review and Preliminary Data in Massachusetts*](#), Sections: (A) IX. *Public Health Framework: Commonwealth of Massachusetts: Regulations and Public Health* (starting on page 93) and (B) *Appendix VI: Public Awareness Campaigns* (starting on page 137), and Report (2), [*More About Marijuana Public Awareness Campaign Effectiveness*](#)]

Consideration 2: The Commission continues a systematic approach to the Responsible Vendor Training (RVT) Program to ensure adequate, evidence-based, and comprehensive training for all cannabis industry agents, including both the adult-use and medical-use marijuana establishments. Currently, only adult-use agents are required to complete three hours of annual RVT education. Targeted survey assessments could assess impact of training on establishment agents and consumers.

Data Collection and Monitoring

Monitoring adult and emerging adult cannabis use using reliable, systematic data is essential to assess changes in trends over time and to better understand the impacts of changing cannabis policy and regulations. The Commission could continue to participate in the ICPS and other



studies with systematic data collection of metrics applicable to the Commission’s Research Agenda. The Commonwealth and its relevant agencies could work collaboratively with researchers to define priority areas of research and consistent data metrics to monitor cannabis use and adverse public and clinical health outcomes systematically in Massachusetts. Given the varying data collection mechanisms implemented across the Commonwealth and its agencies, the state could add metrics to pre-existing surveillance systems to more accurately assess types, methods, frequency and quantity patterns of cannabis use among different cohorts (e.g., age, race/ethnicity, socioeconomic status), and partner with health systems to assess adverse clinical health effects, such as cannabis use disorders, acute psychosis, and co-occurring mental and cannabis use disorders.

Consideration 3: The Commission should continue to use the ICPS data to further assess rates and trends in specific cohorts, including age groups, available racial/ethnicity groups, gender, and socioeconomic status, from 2018-2019. This data allows for specific assessment of both illicit vs. legal market trends and modes of cannabis use over time. If the Commission takes this direction, the Commission’s Research Department could publish a Special Report which would supplement both the industry and social equity data assessments from an industry perspective.

Consideration 4: The Commonwealth or Commission could conduct independent studies to examine nuanced metrics of cannabis use in the Commonwealth across time. The Marijuana Baseline Health Study (2018) conducted by the Massachusetts Department of Public Health (DPH) is among the most detailed reports of cannabis use patterns and perceptions in both a Massachusetts general adult sample and a Massachusetts cannabis patient sample. Continuation of this study and/or a similar study would enable assessment of varying trends in both the general and patient cohorts over time.

Consideration 5: The Commission can continue collaboration with public and private sector researchers and academics, including:

- State researchers and epidemiologists in government cannabis regulatory entities, including public health working groups to continue to identify best practice monitoring tools and learn from states with more established markets; and
- University of Waterloo on the ICPS to continue to assess cannabis use and behaviors, including information about the illicit cannabis market and modes of consumption, two critical but currently under-studied metrics.

Consideration 6: The Commonwealth and its relevant state government agencies could work with healthcare systems, college health centers, and researchers to monitor the rates of cannabis use disorder and adults and emerging adults presenting to any healthcare setting with acute cannabis use symptoms or related cannabis use health concerns. As part of this collaboration, foci could extend to securing ongoing surveillance measurements by the Commonwealth, including:

- Add important cannabis use metrics and/or optional cannabis-specific modules to pre-existing surveillance or data collection systems, including:
 - Behavioral Risk Factor Surveillance System, such as:
 - Frequency of past 30-day cannabis use;

- Method(s) of cannabis consumption in the past 30-days (e.g. smoke, eat, drink, vaporize, dab, other methods of consumption);
 - Where adults 18+ purchased cannabis consumed in the past 30-days (i.e. medical marijuana dispensary, retail store dispensary, home growth, illicit market, friend or relative, and other non-licensed sources)
 - Perceived social norms of cannabis use;
 - Perceived social norms of driving after cannabis use;
 - Perceived risk of harm from driving after cannabis consumption;
 - Perceived social norms of driving after cannabis use;
 - Perceived risk of harm from driving after cannabis consumption;
 - Past 30-day driving after any cannabis consumption behaviors; and
 - Past 30-day riding with a driver who had recently consumed any cannabis product behaviors.
- Continue collaboration with the Council of State and Territorial Epidemiologists, including assessment of optimal Internal Classification of Diseases (ICD) codes for monitoring purposes and systematically monitor and report incidences of cannabis-related ICD-9 and ICD-10 codes in health-care settings, to better understand adult and emerging adult cannabis use and cannabis-related clinical outcomes;
 - Assess metrics in ongoing data collection mechanisms in the Commonwealth, including the Pregnancy Risk Assessment Monitoring System (PRAMS) to assess cannabis use in prenatal and breastfeeding women, two at-risk cohorts, and perceived social norms of cannabis use during pregnancy; and
 - Systematically code and report Poison Control Center data related to cannabis exposures and types of products of exposure.

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