Cannabis Control Commission

COMMONWEALTH OF MASSACHUSETTS

Commissioner Questions and Research Department Answers

Cannabis Use Trends in Massachusetts, Findings from the International Cannabis Policy Study, 2019-2023

April 10, 2026

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I. Executive Summary

This report serves to assess cannabis use trends in Massachusetts, utilizing data from the International Cannabis Policy Study (ICPS). The ICPS is a quasi-experimental population-based survey that allows the monitoring and study of differential effects of cannabis policies and outcomes, including but not limited to prevalence and patterns of use, purchasing and price, consumption and product types, commercial retail landscape, risk behaviors, and knowledge and perceptions. The Research Department assessed ICPS data from 2019-2023 in this report, which contained a total of 11,635 participants from Massachusetts, including the 2019 and 2020 waves previously assessed in the Commission's 2022 ICPS report.

Following the Public Meeting presentation of the Report on March 12, 2026, Commissioners were instructed to submit all report questions to the Research Department from March 12 – March 27. Commissioner questions with Research Department answers are presented below.

The full report can be accessed on the Commission website: Cannabis Use Trends in Massachusetts, Findings from the International Cannabis Policy Study, 2019-2023

II. Questions and Answers

Survey and Report Methodology

Question 1: Describe the process for developing the ICPS report – specifically, how long it takes for the Research Department to complete the finding from start to finish?

Answer 1: We began preparing this report in September 2024, starting with combining the data files for each survey year, cleaning the data, and separating out the survey questions we planned to analyze. We worked on the data tables and other report content for twelve months, completing our internal Research Department draft at the end of August 2025. We then began the review and publishing process, starting with interdepartmental review during the month of September 2025. The report was reviewed and finalized internally through December 2025, then provided to Commissioners for informational review in January 2026 before being presented and published in March.

Question 2: What are the sampling methods you have used, in particular regarding the question about gender differences?

Answer 2: The sampling methods for each survey wave are described in Technical Reports available on the ICPS website. This excerpt from the 2023 wave Technical Report gives an overview of the sampling methodology, which is consistent with the prior survey waves:

> "SAMPLE ELIGIBILITY
> Individuals were eligible to participate if they resided in a Canadian province, US state, Australia, New Zealand, the United Kingdom, or Germany, were 16–65 years of age at the time of recruitment, and had access to the internet.
>
> RECRUITMENT AND CONSENT
> The ICPS sample was recruited using non-probability sampling methods using the Nielsen Consumer Insights Global Panel, which maintains panels in Canada, the US, Australia, New Zealand, the UK, and Germany (About | Nielsen). Email invitations (with a unique link) were sent to a random sample of panelists (after targeting for age and country criteria); panelists known to be ineligible were not invited. Respondents from previous waves were identified using their unique panel ID. The Nielsen panels are

> recruited using both probability and nonprobability sampling methods in each country. Comparisons between the sample profile and national estimates from benchmark population-based surveys are provided below."
>
> *Review the International Cannabis Policy Study: Technical Report, Wave 6 (2023)*

Additionally, the 2023 wave codebook contains this description of the sampling methodology:

> "A non-probability sample of respondents was recruited through the Nielsen Consumer Insights Global Panel and their partners' panels. The Nielsen panels are recruited using a variety of probability and non-probability sampling methods. For the ICPS surveys, Nielsen draws stratified random samples from the online panels, with quotas based on sex, age and state/province of residence. Upon completion, respondents receive remuneration in accordance with their panel's usual incentive structure. Monetary incentives have been shown to increase response rates and decrease response bias in subgroups under-represented in surveys, including disadvantaged subgroups. The cooperation rate, which was calculated based on AAPOR Cooperation Rate #2 as the percentage of respondents who completed the survey among all eligible respondents who accessed the survey link2, was 64.2% in 2018, 62.9% in 2019, 62.0% in 2020, 60.8% in 2021, 60.7% in 2022, and 55.06% in 2023. Surveys were conducted in English in the US, Australia, New Zealand and the UK, in English or French in Canada, and in German in Germany. Median survey time was 20 minutes in 2018, 25 minutes in 2019, 21 minutes in 2020, 22 minutes in 2021, 23 minutes in 2022, and 22 minutes in 2023."
>
> *This codebook was provided to the Research Department along with the 2023 wave dataset.*

Question 3: In the section on Cannabis Use Frequency, the study measures cannabis use by gender. It appears that more women responded to the survey though the percentages between men and women were the same. Any concerns about the higher number of female respondents when considering those survey outcomes?

Answer 3: Great question, as approximately 51.1% of the Massachusetts population are female. This is a question the Research Department will explore in the next contract with the University of Waterloo.

Question 4: Given the importance of youth prevention, would it be possible for the ICPS administrators to over-sample adolescents and young adults in upcoming studies?

Answer 4: Yes, we could request an over-sample of adolescents ("youth"), or any other population subgroups, but this over-sample would require additional funding. The current contract with the University of Waterloo expires this May 2026, giving the Commission an opportunity to provide necessary support for future monitoring and evidence-based decision-making. The Research Department recommends additional funding to increase sample size overall and to oversample the 16-25 year old cohorts for the next contract. This funding increase will allow the Research Department to provide more in-depth analyses on critical questions regarding youth and other cohorts of interest in cannabis policy, such as Black and Hispanic cohorts, in future reports and research analyses.

Note: We provided one combined response to the following four questions due to their similarity.

Question 5i: What would you consider an ideal total sample size for future studies in order to ensure adequate sample size (allowing for reliable conclusions) for the various demographic/response "branches?"

Question 5ii: What are the costs associated with increasing sample size? Is the cost per-participant?

Question 5iii: What is the annual cost of the ICPS contract, and are there options for the Commission to fund additional sampling in future years? What would be the benefits to increasing the sample size?

Question 5iiii: There are references in the study that a larger sample size of MA respondents would be helpful. Does the sample size impact any margin of error? In your opinion, what would be a target survey size? What is an estimated cost for reaching those additional residents?

Answer 5: The larger the sample size, the more precise the metric estimates, providing Massachusetts policymakers with more accurate assessments of M.G.L. 94G Section 17 metrics. Most notably, this is critical for assessment of certain cohorts of interest as we are currently limited by the small sample sizes for adequate comparisons amongst cohorts, such as youth (aged 16-20), emerging adults (aged 21-15), Black/African American and Hispanic cohorts.

Oversampling specific cohorts is recommended to better understand nuances around behaviors and patterns that may be occurring but are currently obstructed by statistically merging cohorts (or "pooling") together in analyses.

The annual cost is dependent on how many respondents we are able to request to oversample. It is $10,000 annually for each oversample of 1,000 respondents. For the May 2025 – 2026 year, we oversampled 2000 respondents in Massachusetts, which was $20,000. Adding the cost of Waterloo's report summarizing the Massachusetts subsample findings and the overhead fee, the current annual total is $32,500. The Research Department recommends sampling at least 5,000 participants annually, and oversampling specific cohorts, including but not limited to: youth, emerging adults, and race/ethnic cohorts to ensure adequate sample sizes for statistical modeling in future analyses. This would require additional funding.

The sample size directly impacts the margin of error for statistical analyses, especially when looking at different subsamples, such as comparing youth (ages 16-20) behaviors to emerging adult (ages 21-25) behaviors. This report does not include statistical testing due in part to the small annual sample sizes and concerns regarding result precision estimates. Larger survey samples would permit statistical modeling and give us more confidence that the data reflects the underlying population and reduce the impact of outlier responses. For example, and as previously discussed, the small number of youth participants (ages 16-20) means that we can't interpret the year-to-year fluctuations in the percent who report using cannabis as indicating the actual year-to-year trend for youth in Massachusetts.

Question 6: As we look ahead to the introduction of social consumption, what data would the Research Department be focused on in future ICPS studies – both information already being collected and what new data would be helpful?

Answer 6: We intend to focus more closely on certain behaviors and cohorts of interest. For example, with the implementation of social consumption sites, it will be critical to understand changes in impaired driving rates as well as continued prevention of any youth access to cannabis from regulated sources. Larger ICPS sample sizes and targeted metrics will permit researchers to assess whether social consumption is related to changes in behaviors or youth cannabis access. More immediately, we plan to start looking at recently added questions on hemp and other cannabinoids to help assess scope of "hemp-derived" vs. "cannabis-derived" markets. We are also planning to propose some new ICPS survey questions ("metrics") this year,

potentially including items on worker safety, public awareness, and Medical Use of Marijuana (MMJ) program registration.

Question 7: On page 34, it states that 47% of students reported obtaining cannabis from a "store." Moving forward, should the study better define the meaning of "store" to distinguish between vape shops, gas stations, or licensed dispensaries?

Answer 7: Yes, this would be a helpful clarification for this study metric. The Research Department is discussing a follow-up question that we may propose for future survey waves to clarify responses to this question. There are also other survey questions about cannabis sourcing behaviors that we did not have time to further examine for this report. Additional staffing or external contracting funds would enable a more comprehensive analysis of this data in the future.

Question 8: It is concerning that nearly 30% did not believe it was dangerous to drive or operate heavy machinery after cannabis use. Would adding more public health awareness or knowledge-based questions to the ICPS study in the future help us get a better understanding where current knowledge gaps exist?

Answer 8: Adding additional metrics could help understand the public's knowledge in future survey waves. Even without data from additional questions, we still recommend ongoing public awareness campaigns and similar to address current knowledge gaps apparent in this survey data, especially with the rollout of Social Consumption and with data indicating continued underage cannabis use (even if we are still working to understand how underage residents are accessing cannabis and whether these reported products are "hemp-derived" vs. "cannabis-derived"). Continued public education (vs. one-time campaigns) are necessary to ensure continued education and awareness of impacts of cannabis. As science learns more, it is critical to relay knowledge to the Massachusetts constituency.

III. Interpreting the Data

Question 1: Can you share/publish the exact survey questions, or are they considered proprietary?

Answer 1: We included survey question text in the Methods section to aid in interpreting the results throughout the report. We would be happy to meet with any Commissioner to discuss these survey questions and metrics if requested.

Question 2: What strategies or safeguards are incorporated into the sampling and survey methods to ensure accurate and truthful responses on a topic that some may consider sensitive/taboo.

Answer 2: Information about "data integrity" is provided in the Technical Report for each survey wave (all reports available on the ICPS website). This excerpt from the Technical Report for the 2023 survey wave describes the procedure for ensuring data integrity, which is the same for all survey waves:

> "Due to the potentially sensitive nature of the subject matter (e.g., non-medical cannabis was classified as an illegal substance federally in the US, Australia, New Zealand, the UK, and Germany at the time of the 2023 survey), at the end of the survey, respondents were asked whether they felt they were able to answer the questions honestly. The 1,629 respondents who selected 'no' were excluded from the analytic sample. Towards the end of the survey, respondents were also asked to select the current month from a list. The month selected by the respondent was compared to the month the respondent completed the survey. Respondents with discrepant responses were excluded from the analytic sample, unless the selected month was within 2 days of the date the survey was submitted (e.g., survey completed on Oct 1-2 but respondent selected September)."
>
> *Review the International Cannabis Policy Study: Technical Report, Wave 6 (2023)*

Question 3: Study showed 14% of respondents said that they had driven within two hours after consuming cannabis. Do survey questions like this affect results as some respondents may not wish to admit this error in judgement in a survey?

Answer 3: "Social desirability bias" is a general limitation of survey research – it is always possible that survey participants are giving answers that they think are "socially desirable," and we have no way of knowing for certain how much this could have affected responses to the ICPS survey. However, because this survey is conducted through a panel, and because participants are told that their responses are anonymous, we are generally confident that participants in the ICPS survey are honest enough for the data to be useful and informative. Moreover, as described above, participants who indicated that they were not able to answer the questions honestly were excluded from the analytic sample.

Question 4: Under Policy Recommendations, the topic of Hemp Derived Products is discussed. Do you think that respondents may be considering these products and cannabis are one in the same?

Answer 4: We do, and this is a concern shared by many other researchers. Dr. David Hammond, who leads the survey, actually examined this issue within the ICPS last Fall, and did find evidence that a substantial portion of participants are probably conflating these products. We don't know enough yet to say exactly how this impacts survey results or the full scope of issue, but this does highlight how important it is to ask participants about their knowledge of these products in any survey about cannabis use. The confusion about which products people are using, and where they're sourcing them, makes it much harder to interpret data on cannabis use and regulated sourcing specifically.

Question 5: On page 26, the report notes the mean age of initiation was youngest among individuals under 25 years of age. Is it possible some of the reported use could reflect hemp-derived unregulated products, rather than cannabis from the regulated market?

Answer 5: It is certainly possible that reported use among youth at least partially reflects increased access to hemp-derived and other intoxicating cannabinoid products outside of the regulated cannabis market in Massachusetts. Smoke shops and out-of-state online retailers, for example, are not under the Commission's regulatory purview, and these businesses may sell intoxicating hemp-derived products that are able to be purchased without age verification. Additionally, as we discussed in our presentation, we would logically expect the mean age of initiation to be lower in younger age groups. The 16-20-year-olds who have tried cannabis must, by definition, have a maximum age of initiation of 20 years old; the 21-25-year-olds who have tried cannabis could have tried it at 25 years of age, and so on for the rest of the age groups in this study.

Question 6: Is there an opportunity to look at initiation data and draw any conclusions on how legalization may have impacted those numbers especially for younger age brackets (16-20 and 21 to 25)? Can NSDUH data provide any additional data to understand why some respondents were initiated into trying cannabis at a young age?

Answer 6: For a more detailed look at current results of the National Survey on Drug Use and Health (NSDUH), please see the results of the 2024 NSDUH survey.

If the youth cohort (ages 16-20) sample sizes were larger in the annual ICPS surveys for Massachusetts, we might be able to assess more precisely whether legalization is impacting age of initiation. We know that delaying the age of cannabis use initiation is critical for public health and for youth safety and future impacts. These tables show the mean age of initiation by age group and ICPS survey year. Again, please note that these are **descriptive** statistics – we have not conducted hypothesis testing to determine if any changes from year to year are statistically significant.

Among the 16-20-year-old age bracket:

Survey Year	Mean Age of Cannabis Initiation (in	*n*	Standard Deviation (in years)
2019	16.01	139	1.96
2020	15.79	130	1.63
2021	16.31	94	1.96
2022	15.82	161	2.01
2023	15.67	103	1.37

Among the 21-25-year-old age bracket:

Survey Year	Mean Age of Cannabis Initiation (in years)	*n*	Standard Deviation (in years)
2019	17.23	173	3.23
2020	17.63	140	3.46
2021	17.24	119	4.22
2022	17.97	262	3.43
2023	17.91	145	3.25

Unfortunately, neither these descriptive statistics from the ICPS survey, nor the NSDUH data, can tell us why these survey participants first tried cannabis at any particular age, or the reasons behind any trends over time.

Question 7: Data in the report highlights the number of respondents who answered in the affirmative that they were arrested for cannabis impaired driving. In MA, motor vehicle drivers can be arrested for impaired driving though no test is approved for measuring the impairment from cannabis. Do you think respondents are acknowledging that the arrest for impaired driving was directly related to their cannabis consumption?

Answer 7: The exact ICPS question wording was "Have you ever been arrested for any of the following cannabis offenses…?" and the response options were "Cannabis possession", "Cannabis trafficking, cultivation or importation", and "Cannabis-impaired driving". It would be reasonable to say that participants who answered in the affirmative for each arrest type believed that that was the reason for their arrest. It is possible that affirmative responses could be acknowledging the behavior; however, it is also possible that some participants did not (or believe they did not) engage in the behavior(s) they were arrested for, even though they are acknowledging the arrest(s) in their survey response. Given that this is an anonymous survey and there are no linked data on arrests or convictions, the only information we have is the participants' self-reported responses.

Question 8: 21% of respondents reported driving with someone who had used cannabis. Any conclusion to be made that would indicate those respondents had also been consuming cannabis?

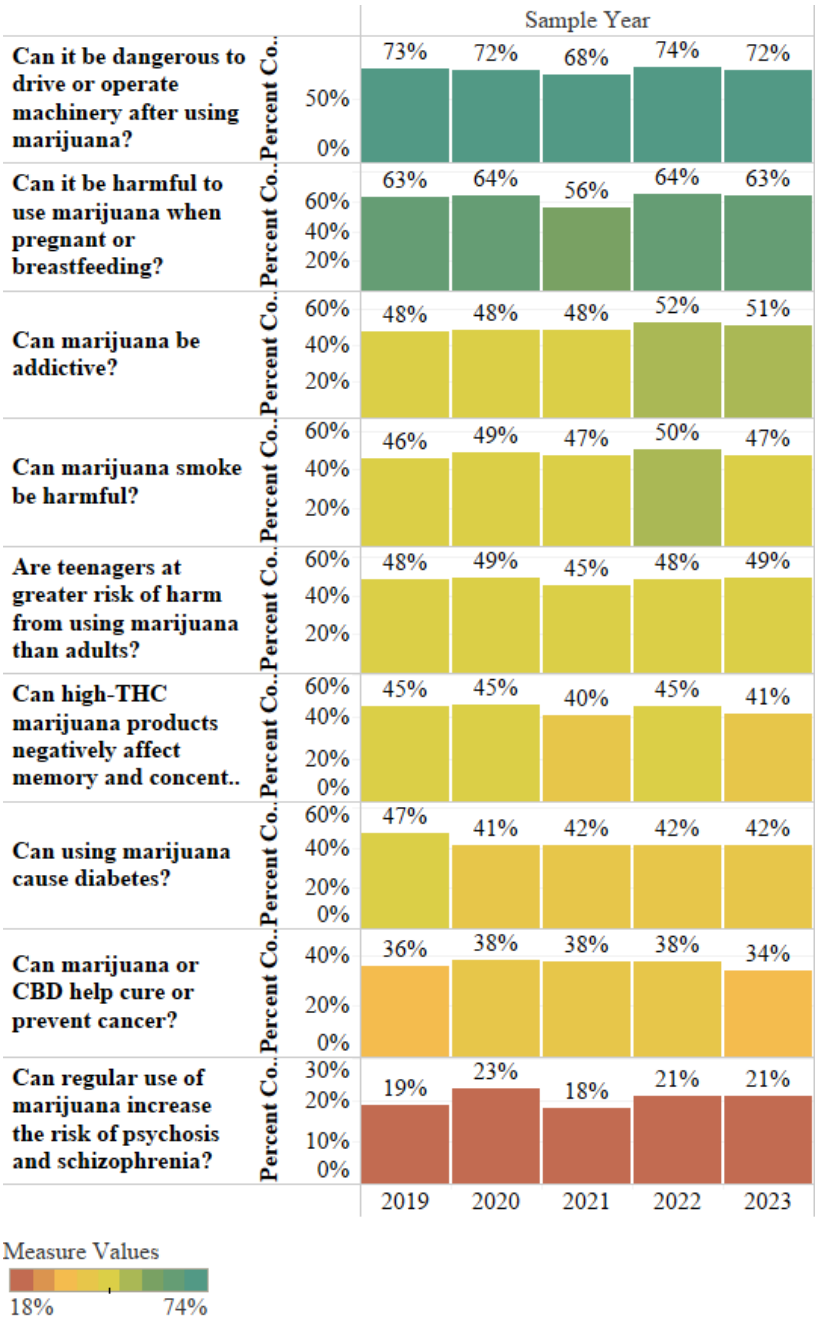
Answer 8: Great question! We would not conclude this based on this survey data and design. Even if survey participants who reported being a passenger to someone who had recently used cannabis also reported higher rates of cannabis use (relative to those who did not report being a passenger), we would not be able to infer that those participants were meaningfully more likely to be using cannabis at the same time as riding in the car with a driver who had recently consumed cannabis.

Question 9: In Questions about Side Effects, we see that 72% of respondents say that it can be dangerous to drive or operate machinery after using marijuana. How does this number align with the respondents who said they did operate a motor vehicle within two hours of consuming cannabis? Have we asked the question before about the awareness of the danger of driving in previous studies or through other data sources to see if awareness is headed in the right direction?

Answer 9: The knowledge questions have been asked in every year of available survey data (2018 onward). To shed more light on this particular question, we created a table observing the percent of correct responses to the driver knowledge question ("Can it be dangerous to drive or operate machinery after using marijuana?") stratified by whether they reported having driven a vehicle within 2 hours of cannabis use in the past 12 months:

IN THE PAST 12 MONTHS: Have you driven a vehicle (e.g., car, snowmobile, motor boat, or an offroad vehicle (ATV)) within 2 hours?	**Percent of correct responses to "Driver" Question**
Yes, in the past 12 months	43.6% (*n* = 493)
No, never or not in the past 12 months	76.8% (*n* = 3,077)
Don't know or Refuse to Answer	39.5% (*n* = 124)

Further, we also recreated the figure looking at the percent of correct responses per knowledge question, this time stratified by the participant's Sample Year:



Question 10: How do 'methods of consumption' covered in this report differ from the industry report from last year?

Answer 10: Both reports examine product types or "methods of consumption" from a very high level. Comparing the "methods of consumption" from the ICPS against the "product categories"

from the Industry Report, we noted a few differences. Where the ICPS reports separately on "Concentrates" and "Hash/Kief" (types of 'solventless' concentrate), for the Industry Report "Kief" was included with the Concentrate categories for brevity in reporting. Further, where the Industry Report separates out "Shake/Trim" (trimmings from processing flower products), "Pre-Rolls", and "Infused Pre-Rolls" (pre-rolls containing flower as well as concentrate products) from the general "Flower" category, the ICPS "Methods of consumption" question does not. The Industry Report also includes data on "Cultivation" products (Seeds, Immature Plants, and Fresh Frozen Flower) and two "Bulk" product categories, which are not directly consumed, and are therefore not included in the ICPS survey. "Drinks" and "Edibles" are both reported on separately in the ICPS and Industry Reports, but we included both in the same category in the Industry Report due to the small number of sales of "Drinks" at the time we analyzed the data. The table below shows a comparison between the product categories included in the ICPS Report, and their analogous categories from the Industry Report:

<table>
<tr><th>ICPS Product Type</th><th>Industry Report Equivalent(s)</th><th>Notes</th></tr>
<tr><td rowspan="5">Flower</td><td>Buds</td><td></td></tr>
<tr><td>Shake/Trim</td><td rowspan="2">Small leaves or plant material leftover from cultivation of buds/Flower; ICPS "Methods of consumption" question does not ask about the form of flower product used.</td></tr>
<tr><td>Shake/Trim (by strain)</td></tr>
<tr><td>Infused Pre-Rolls</td><td rowspan="2">Pre-rolled cannabis Flower product; ICPS "Methods of consumption" question does not ask about the form of flower product used.</td></tr>
<tr><td>Raw Pre-Rolls</td></tr>
<tr><td>Edibles</td><td>Infused (edible)</td><td rowspan="2">Edibles and Drinks categorized together in Industry Report as "Infused Edibles and Beverages"</td></tr>
<tr><td>Drinks</td><td>Infused Beverage</td></tr>
<tr><td>Oils, Vaporized</td><td>Vape Product</td><td></td></tr>
<tr><td>Oral Oils</td><td rowspan="2">Infused (non-edible)</td><td>"Infused non-edible" is defined in the Industry Report as "Cannabis-infused products that are not taken through oral consumption and digestion. This includes a range of products such as tinctures and transdermal patches."</td></tr>
<tr><td>Topicals</td><td></td></tr>
</table>

Tinctures		
Concentrates and Hash/Kief	Kief	Solventless concentrated cannabis product; Kief was included under the "Concentrates" category in the Industry Report
	Concentrate	
	Concentrate (Each)	
Industry Report product categories with no ICPS equivalent	Suppository	
	Immature Plants	Cultivation products that are not directly consumed "Intermediary" product categories that do not refer to products available for sale to consumers
	Seeds	
	Fresh Frozen Flower	
	Infused Liquid (Bulk)	"Intermediary" product categories that do not refer to products available for sale to consumers
	Infused Beverages (Bulk)	
	Concentrate (Bulk)	

The Industry Report included data on sales by product type, and found that "Buds accounted for the largest portion (42.2%), followed by Vape cartridges (18.4%), Prerolls (15.0%), Infused edibles and beverages (14.7%), and Concentrates (7.6%)" (page 34). The ICPS Report included data on which "methods of consumption" participants reported having used within the past 12 months, and found that "across the entire sample, 'Flower' (70%), 'Edibles' (67%), and 'Oils, Vaporized' (39%) were most reported as used within the past year" (page 28). The large portion of participants reporting edible use in the ICPS Report, compared with the relatively smaller share of sales for edibles reported in the Industry Report, may reflect a large consumer base for these products that includes many infrequent purchasers. By contrast, vape cartridges account for a larger portion of sales compared to edibles, so the ICPS data showing a smaller number of participants using vapes compared to edibles may reflect a smaller overall consumer base with more individuals who purchase frequently.

Review the 2025 Industry Report: Review and Assessment of the Massachusetts Adult- and Medical-use Cannabis Industries

Question 11: How do these results correlate with the results of the MGH study?

Answer 11: Neither study provides definitive answers about the impact of legalization (or "commercialization," from the MGH study) on youth use. There is very limited "pre to post" measurement; ICPS data was not available until 2018, and the MGH study looks at change in use from pre-commercialization in 2017/2018 to post-commercialization in 2018/2019, which offers no information about causation.

There is also no other evidence provided tying the increase in THC cannabinoid positivity rates to the expansion of the regulated cannabis market in Massachusetts. The study does not adequately distinguish the state-regulated cannabis market from the unregulated hemp-derived cannabinoid market that arose nationwide after the passage of the 2018 federal Farm Bill. It is important to note that this bill essentially legalized hemp-derived cannabinoid products (classified as containing <0.3% Delta-9 THC on a dry-weight basis) at the federal level by removing them from the Schedule I status under the Controlled Substance Act. Concerns about other THC cannabinoids (e.g., Delta 8- THC) and novel synthetic cannabinoids in hemp-derived products led to recent amendments to this bill in 2025 (HR 5371) to take effect in November 2026. In this change, hemp-derived products will have a "total" vs. solely Delta-9 THC threshold to include all THC and isomers (e.g., Delta-8, Delta-10, and THCA). These amendments also ban cannabinoids that are not naturally produced by the plant, with the intention of decreasing synthetic cannabinoids in hemp-derived products.

There are also issues to consider regarding study samples. ICPS data is highly limited by the small sample size of youth in MA. The MGH study has a much larger sample size, but it is a sample specific to youth admitted for psychiatric care, which should not be generalized to all youth in Massachusetts. While the MGH study is a critical step in understanding the impacts of cannabis use among vulnerable youth, it serves as better evidence for cannabis use concerns among youth with psychiatric conditions and symptoms than as evidence for the regulated market increasing youth access. Ultimately, both studies highlight how much a comprehensive look at a large, representative sample of constituents, including youth, is needed in Massachusetts to provide more guidance to policymakers, researchers, and clinicians alike. Pursuant to M.G.L. 94G Section 17(a)(iii), the Massachusetts Cannabis Control Commission ("Commission") is mandated to assess "incidents of impaired driving, hospitalization and use of other health care services related to marijuana use, including a report of the state of the science around identifying a quantifiable level of marijuana-induced impairment of motor vehicle operation and a report on the financial impacts on the state healthcare system of hospitalizations related to marijuana." Because the Commission's research mandate is unfunded by the Legislature, this comprehensive study that warrants external contracted expertise has yet to be completed, limiting important information for effective decision-making.

IV. Policy Recommendations and Implications

Question 1: What do you believe are the most important recommendations for the state and the board to focus on.

Answer 1: Despite having significant statutory responsibilities for public health and safety under M.G.L. Chapter 94G, Section 17, the Research Department has long been—and continues to be—understaffed and underfunded. While the cannabis industry is no longer new, scientific understanding remains limited, leaving regulators without the breadth and depth of data needed for effective, evidence-based policymaking. This gap affects critical areas such as clinical treatment and prescribing, education, road safety, social equity, public health, and criminal justice. Upcoming legislative changes may expand research and reporting obligations, yet without adequate funding, research will remain under-supported, to the detriment of the Commonwealth's constituents. Strengthening this capacity is essential for the successful implementation of social consumption policies and the oversight of hemp-derived intoxicating products, which currently lack comparable safety regulations. The following points from various report recommendations would align the Commission's research capabilities with its operational scope and enable data-driven decisions that protect public health and safety, including disproportionately impacted cohorts.

- Research support, including:
    - Increased support for collaborations with Commission departments, sister agencies in the Commonwealth, and regulators and researchers across the U.S.;
    - Increased support for collaborations to understand the scope of the hemp-derived market and its impacts;
    - Earmarked fiscal resources to expand research capacity and personnel to fulfill metrics not yet funded in a comprehensive manner, such as M.G.L.94G Section 17(a)(iii) "healthcare study" and M.G.L.94G Section 17(a)(vi) "school study" as well as additional reporting included in the new legislative bill.
    - Increased fiscal resources for the ICPS contract to permit recruitment of larger sample sizes annually and oversampling specific cohorts of interest, such as youth;
    - Increased fiscal resources for ongoing public awareness and education to ensure constituents understand both the laws and effects of cannabis use to make informed decisions;

  - Increased support for internal data infrastructure to ensure capture of entities of interest, such as equity programming and agent-level data, testing abnormality detection, and supply and demand assessments.
- Leadership and fiscal support to start the Center for Cannabis Research and Policy (CCRP), a center for collaborative research within a regulatory agency but separated from regulatory functions. The CCRP, if implemented, could serve as a fact-finding arm to the Commission—serving to better understand cannabis legalization trends, ensure quality and safety of products for consumers and industry workers alike, and make effective recommendations for Massachusetts to continue leadership in cannabis regulation.

Question 2: Under Policy Recommendations (Education and Prevention), you highlight the importance of worker safety. Is that recommendation based on data in the study about respondents who answered they used before work or during work? What can the study's datasets tell us about this issue or is it a consideration for future research opportunities?

Answer 2: While the survey data does indicate some cannabis use at or soon before work, this recommendation is primarily based on a concern for what we know about testing and cannabis industry worker safety, which is an important part of public health, but is *not* as well-studied as consumer and patient health.

Question 3: It is encouraging that more people seem to be moving from unregulated market(s) to regulated market(s), how do you think any move to curb over saturation/e.g. cultivation freeze impact this trend, if at all?

Answer 3: We believe it is reasonable to say (in the absence of a more in-depth market analysis or supply and demand study) that if cannabis products from the regulated market are less expensive than those from the unregulated market, then this will help draw consumers to the regulated market. If a licensing freeze leads to an increase in regulated market prices, then this could risk driving some consumers back to the unregulated market. A temporary freeze of cultivation while a market analysis and supply and demand study is conducted could provide more information about how Commission regulation of different licenses might better secure the markets, including prices, saturation, profitability, and how these may impact consumer behavior. Cannabis is still a federally illegal substance and innovative market; regulatory timeliness is critical to ensure effective regulation.

Question 4: Specifically regarding the finding that only "20% answered that regular marijuana use can increase the risk of psychosis and schizophrenia," does the Research Team have any policy or educational recommendations to bring greater awareness to this issue?

Answer 4: Cannabis research, especially plant-touching research, lags behind policy, thus, so does pertinent information policymakers need to make safe, evidence-based decisions. There is growing evidence about the relationship between cannabis use and mental health disorders, especially when initiation occurs in youth. As the science evolves and we collectively understand more on cannabis use and impacts, it is critical that regulators include new information in public awareness and education materials. Recommendations to rectify this may include:

- Fiscal support for ongoing (vs. one-time) public awareness campaigns and materials. As science evolves, it is critical to also inform the consumers and constituency for their education and decision-making;
- Fiscal support to increase ICPS contract funding to include recruitment of larger sample sizes and oversampling of specific cohorts. These data reflect all survey respondents, but it is critical to understand how different cohorts understand cannabis effects to better prevent or intervene in patterns before they become problematic for individual consumers as well as the state's infrastructure (healthcare, education, and criminal justice systems specifically).

Question 5: Can you explain 'cannabis use disorder' and how you define it?

Answer 5: We would use the definition of "cannabis use disorder" in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). The DSM-5 defines cannabis use disorder under substance-related and addictive disorders as cannabis use that leads to clinically and significant impairment or distress—not just frequent or heavy use. The DSM-5 includes 11 criteria, for which an individual needs to meet 2:11 metrics for diagnosis, and the diagnosis has three levels of severity: 1) Mild (2-3 symptoms); 2) Moderate (4-5 symptoms); and 3) Severe (6 or more symptoms).

Diagnostic criteria include:

1. Cannabis is often taken in larger amounts or over a longer period than intended;
2. Persistent desire or unsuccessful efforts to cut down or control cannabis use;
3. A great deal of time is spent obtaining, using, or recovering from cannabis;
4. Craving, or a strong desire or urge to use cannabis;

5. Recurrent use resulting in failure to fulfill major role obligations at work, school, or home;
6. Continued use despite persistent or recurrent social or interpersonal problems caused or exacerbated by cannabis;
7. Important social, occupational, or recreational activities are given up or reduced because of cannabis use;
8. Recurrent use in situations in which it is physically hazardous;
9. Continued use despite knowledge of having a persistent or recurrent physical or psychological problem likely caused or exacerbated by cannabis;
10. Tolerance, defined by either a need for markedly increased amounts to achieve desired effect, or markedly diminished effect with continued use of the same amount; and
11. Withdrawal, shown by the characteristic cannabis withdrawal syndrome or cannabis taken to relieve/avoid withdrawal.

See Connor, Stjepanovi et al. Cannabis Use and Cannabis Use Disorder. Nat Rev Dis Primers (2021) for additional information.

Question 6: Under Income Adequacy, is there a connection to be made between concern over high prices as a Reason for Avoiding Legal Cannabis purchase and the trend of more consumers turning to "Stores" for purchases instead of purchasing through a friend or making a purchase from a dealer?

Answer 6: While we can't infer anything causal from this data, we think it's reasonable to look at the decrease in participants reporting that legal cannabis is too expensive, and the simultaneous increase in legal sourcing, and take these as evidence (even if it is not proof) that lower prices are drawing more consumers into the regulated market.

Question 7: The findings mention the challenges of collecting data that may already be collected by the MA Center for Health Information and Analysis and MA Poison Control Center. Specifically what data is needed and how could it impact CCC policymaking going forward?

Answer 7: Pursuant to M.G.L. 94G Section 17(a)(iii), the Commission is required to assess the following:

1. Incidents of impaired driving;

2. Hospitalization and use of other health care services related to marijuana use, including a report of the state of the science around identifying a quantifiable level of marijuana-induced impairment of motor vehicle operation; and
3. Report on the financial impacts on the state healthcare system of hospitalizations related to marijuana.

Again, since the Commission's research mandate is unfunded, this comprehensive study, warranting externally contracted expertise, has yet to be completed, hindering important information for effective monitoring and decision-making.

CHIA data includes the Massachusetts All-Payer Claims Database, the most comprehensive source of health claims data from public and private payers providing insurance to Massachusetts residents and employees; and Case Mix Data, including the Hospital Inpatient Discharge Database (HIDD); Emergency Department Database (EDD); and Outpatient Observation Database. Together, these datasets could provide the Commission and Legislature with relevant information about impacts on cannabis legalization on the healthcare system. Other government agencies use CHIA data for public health initiatives, preventable hospitalizations, hospital market analysis, alternative care settings, and comparative costs and outcomes in acute care hospitals. The Commission could also use this data to satisfy M.G.L. 94G Section 17(a)(iii) and support collaborations between the research department and external researchers to understand health and clinical impacts to guide future policy decision-making, such as public awareness materials, integrating cannabis care with other clinical care modalities, clinical effectiveness and guidance, etc.