NORC at the University of Chicago

ISSUE BRIEF
January 2025

Medical Cannabis: Time to Act

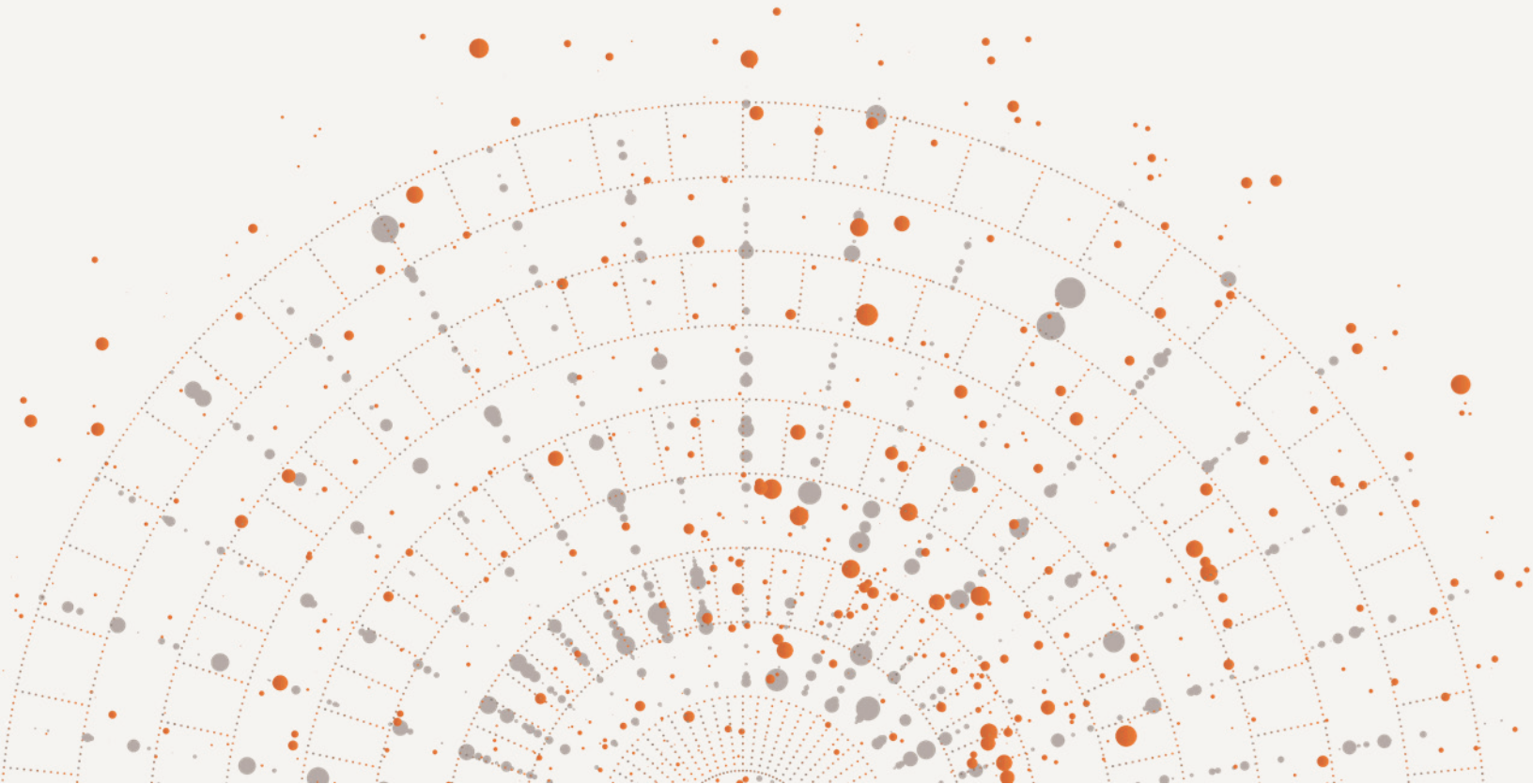
Evidence-Based Strategies for Patient-Centered Care in Massachusetts

Presented by:
Alexandra F. Kritikos

NORC at the University of Chicago
1 Broadway
Cambridge, MA 02142

Presented to:
Massachusetts Health Policy Forum

Brandeis University
Massachusetts Health Policy Forum
415 South Street MS 035
Waltham, MA 02453



Authors

NORC at the University of Chicago
Alexandra F. Kritikos
Simran Chugani

Acknowledgments

NORC wishes to acknowledge the contributions and support of Dr. Kristina Lowell, with insights from stakeholders Dr. Julie K. Johnson, Dr. Peter Grinspoon, Dr. Marion McNabb, Gibran Washington, and Sean Collins. Their expertise and perspectives have been instrumental in shaping this analysis of Massachusetts's medical cannabis surveillance and research landscape. We would also like to thank Dr. Connie Horgan of the Brandeis-Harvard SPIRE Center at the Heller School for Social Policy and Management at Brandeis University for her insightful review and contributions to this brief. Additionally, we appreciate the thoughtful feedback of several anonymous colleagues. Finally, we extend our gratitude to the Massachusetts Health Policy Forum for their support in advancing this research.

Disclaimer

This issue brief is intended to provide a high-level overview of medical cannabis research and related policy considerations. The cited medical cannabis research is not a comprehensive inventory of all published studies, a systematic review, or meta-analysis. Given the evolving nature of cannabis research, other studies, guidelines, or expert perspectives may exist that are not included in this brief. This document is designed to inform policy discussion, rather than to serve as clinical or legal guidance.

Table of Contents

List of Exhibits

List of Tables

Table of Abbreviations

Abbreviation	Definition
APCD	All-payer claims database
CANNRA	Cannabis Regulators Association
CBD	Cannabidiol
CCC	Cannabis Control Commission
CME	Continuing medical education
CUD	Cannabis use disorder
DEA	Drug Enforcement Administration
DPH	Department of Public Health
FDA	Food and Drug Administration
HHS	U.S. Department of Health and Human Services
NASEM	National Academies of Sciences, Engineering, and Medicine
NORC	NORC at the University of Chicago
MTC	Medical Marijuana Treatment Center
PDMP	Prescription Drug Monitoring Program
PHDW	Public Health Data Warehouse
RCT	Randomized control trial
RMD	Registered marijuana dispensaries
THC	Tetrahydrocannabinol
USP	U.S. Pharmacopeia

Executive Summary

Medical cannabis use has grown significantly across the United States, with increasing recognition of its therapeutic potential [1]. As of 2025, thirty-eight states and the District of Columbia have legalized medical cannabis, representing a growing policy shift toward its acceptance [2]. Over the past decade, the scientific literature on cannabis pharmacology, therapeutic applications, and medical use has grown at a rapid pace, with greater interest in the effects of cannabis, clinical potential, and its changing role in health care [1, 3, 4].

Despite such growth, regulatory frameworks and clinical standards for medical cannabis remain inconsistent, unlike conventional pharmaceuticals [5]. Federal restrictions have limited clinical trials, and wide variability in state policies complicates access and medical oversight [1, 6]. As public acceptance and demand for medical cannabis continue to grow, health care providers are receiving more frequent inquiries regarding use and accessibility [7]. The lack of clear, evidence-based prescribing guidelines leaves many health care providers uncertain about dosing, administration, and patient monitoring [8-17]. As a result, patients frequently rely on dispensary staff, online sources, or social networks for information, often leading to unreliable guidance [18-20]. In addition, the market has seen a surge in high- tetrahydrocannabinol (THC) cannabis products, raising concerns about appropriate dosing, potential adverse effects, and overall patient safety [21, 22]. Inconsistent product labeling further complicates decision-making, making it difficult for patients to accurately assess potency, cannabinoid composition, and therapeutic suitability [23].

Since legalizing medical cannabis in 2012 and adult-use cannabis in 2016, Massachusetts has established a regulated system aimed at promoting public health, safety, and equitable access. The Massachusetts Cannabis Control Commission (CCC), an independent agency, oversees both medical and adult-use cannabis markets, managing licensing, compliance, and patient access [24]. The Massachusetts Medical Use of Marijuana Program is the state's framework for medical cannabis patients, offering a regulated pathway for obtaining and using cannabis for therapeutic purposes. Medical cannabis patient enrollment grew steadily between 2014 and 2020, than has plateaued and declined, with 91,758 active patients as of 2024 [25]. The adult-use market has expanded rapidly; there are over 350 adult-use dispensaries, compared with 103 Medical Marijuana Treatment Centers (MTCs) for medical patients. Evidence suggests that medical cannabis program participation often declines following the introduction of adult-use markets [26]. Given the established therapeutic benefits of cannabis for managing medical conditions and symptoms, it is critical to ensure the long-term viability of the medical program. A sustainable and well-regulated medical cannabis program is key to providing safe, effective, and equitable access to products tailored to patients' diverse health care needs.

Medical cannabis use is widespread, yet at the federal level, cannabis remains a Schedule I substance, a designation that restricts funding and creates barriers to research [27]. The U.S. Department of Health and Human Services (HHS) has recommended reclassifying cannabis as a Schedule III substance, signaling a potential shift in federal policy [28]. If enacted, the reclassification could lower

research barriers, expand access to federal dollars, and establish clear clinical guidelines. Aligning federal and state policies could provide Massachusetts with a stronger foundation to advance its medical cannabis program.

This issue brief reviews the Massachusetts medical cannabis program, analyzing its strengths, challenges, and opportunities for improvement. Our review draws on state-level data, stakeholder interviews, academic literature, national trends, and comparative insights from other state medical cannabis programs. We present evidence-based considerations across six areas:

- **Regulatory Framework:** Evaluate Massachusetts's legal foundations and oversight mechanisms, identifying areas for regulatory alignment and clarity.
- **Availability and Access:** Examine financial, geographic, and systemic barriers that affect equitable patient access to medical cannabis.
- **Research and Surveillance:** Assess current data collection, surveillance systems, and research funding, identifying gaps and opportunities for evidence-based policy improvements.
- **Public Health Education:** Review patient, provider, and MTC staff education, emphasizing the need for standardized training and evidence-based guidance.
- **Product Quality and Testing:** Analyze product safety standards, contamination risks, potency consistency, and labeling transparency.
- **Potential Federal Rescheduling:** Examine reclassification of cannabis to Schedule III and implications for research, clinical integration, and state-federal policy alignment in Massachusetts.

The brief presents policy considerations within each domain aimed at strengthening oversight, improving access, and enhancing program effectiveness to ensure that Massachusetts's medical cannabis program meets changing patient and public health needs.

Key Challenges

Massachusetts's medical cannabis program faces challenges regarding access barriers, product safety, education and training, and research infrastructure. These challenges affect prescribing practices, patient education, product availability, and patient care, specifically related to:

- The absence of standardized clinical guidelines and dosing protocols, leading to uncertainty among patients, health care providers, and MTC staff.
- Financial barriers—including high out-of-pocket costs and lack of health insurance coverage—that restrict patient access.
- Geographic disparities that limit access to medical cannabis facilities, particularly in rural and underserved urban regions.
- Gaps in provider and dispensary staff education, resulting in inconsistent guidance and fragmented care delivery.

- Product safety concerns—including inconsistent labeling, contamination risks, and potency variations—that undermine therapeutic reliability.
- Limited research and surveillance infrastructure that restrict evidence-based policymaking and clinical best practices.

Opportunities for Improvement

Massachusetts can strengthen its medical cannabis program in several areas, including affordability and access, education, research, and product safety.

Affordability and Geographic Access: Addressing financial and geographic barriers may improve patient access to medical cannabis. Standardizing discount programs for veterans, seniors, and low-income patients, introducing tax exemptions for medical cannabis purchases, and expanding telehealth and mobile delivery services may increase equitable access.

Provider and MTC Knowledge and Patient Education: Expanding provider education through clinical guidelines and cannabis-focused Continuing Medical Education (CME) programs may help health care professionals ensure safe and effective medical cannabis use. Treatment monitoring and patient outcomes may be improved by standardizing patient-provider communication, including structured follow-up protocols. Strengthening MTC and dispensary staff training while clearly defining their non-medical advisory roles may ensure consistent, evidence-based guidance. Further, enhanced public education initiatives—by developing patient-centered resources on cannabinoid profiles, safe use, and the risks associated with high THC products—may improve patient decision-making and program effectiveness.

Research and Surveillance: Research on patient outcomes, product safety, and long-term efficacy benefits from a stable funding model. Strengthening data infrastructure through expanded patient tracking and integration with health monitoring systems may enhance surveillance, as well as inform policy decisions. Greater transparency, including public access to anonymized data, could improve regulatory oversight and facilitate independent research. Prioritizing targeted studies on treatment efficacy and safety across different patient populations could help refine clinical guidelines and support evidence-based policymaking.

Product Safety and Testing: Ensuring consistent product safety and quality is vital for patient trust and therapeutic reliability. Testing standards can be tailored specifically for medical cannabis products to address safety concerns, for example, with thresholds for contaminants such as mold and heavy metals. Patient confidence may be further enhanced through stronger laboratory oversight with standardized protocols, regular audits, and third-party verification, along with improved labeling transparency through QR codes and batch-specific testing data. Establishing centralized adverse event reporting systems may also improve monitoring and accountability.

Each domain of the issue brief includes a comprehensive list of policy considerations.

Conclusion

The Massachusetts Medical Use of Marijuana Program operates within a changing regulatory and health care landscape. While the state has established a structured framework, ongoing challenges relate to affordability and access, provider education, research, and product safety. Ensuring patients and providers have access to standardized, evidence-based guidance is critical to improving program effectiveness and patient outcomes.

To address these challenges, Massachusetts must strengthen oversight, enhance research efforts, and align its policies with emerging scientific evidence. Achieving these goals will require active collaboration among policymakers, health care providers, researchers, patient advocates, and the broader health care system. Experiences in other states demonstrate that data-driven policy adjustments and expanded research efforts can contribute to a more effective medical cannabis program. By prioritizing evidence-based approaches and fostering cross-sector collaboration, the state can ensure long-term sustainability, patient safety, and regulatory integrity of its medical cannabis program in a rapidly evolving policy environment.

1. Introduction and Background

Medical cannabis has become a significant component of health care in the United States, with millions of Americans using it for symptom management across a range of conditions [29]. As of 2023, over 3.87 million Americans are registered medical cannabis patients, reflecting growing acceptance and utilization [30]. However, clinical guidance remains inconsistent due to federal restrictions, fragmented regulations, and a lack of standardized dosing protocols [1]. The cannabis market continues to grow, with thirty-eight states and the District of Columbia operating medical cannabis programs alongside expanding adult-use markets [2]. Despite this growth, accessibility, affordability, product safety, and public health education remain critical challenges. These complexities necessitate a comprehensive understanding of federal policy, clinical research, and cannabis pharmacology to inform regulatory decisions and optimize patient care [1]. This section examines the federal regulatory landscape, highlighting how evolving policies and regulatory fragmentation impact state-level programs like Massachusetts. It also reviews the state of medical cannabis research, focusing on efficacy, safety, and adverse events, while providing an overview of cannabinoids, methods of consumption, and dosing challenges (**Exhibit 1**). The Massachusetts Medical Use of Marijuana Program (referred to also as the state's medical cannabis program) operates within a complex and shifting policy environment, balancing state-level advancements with ongoing federal restrictions. Understanding the broader federal context, the latest medical cannabis research, and the pharmacology of cannabinoids is essential to evaluating the current landscape and future direction of medical cannabis policy in the Commonwealth. For clarity on key terms used throughout this document, please refer to the Glossary of Terms **(Attachment 1)**.

Exhibit 1. Key Insights: Introduction to Massachusetts's Medical Cannabis Program

Domain	Key Insight
Leadership in Reform	Massachusetts, like other states, faces challenges in supporting medical cannabis patients with robust, evidence-based standards.
Knowledge Gaps in Research	Federal barriers, including Schedule I classification, hinder scientific research and clinical guideline development. Fragmented regulations create inconsistencies in product safety and standards.
Product Complexity and Evolving Use Patterns	Cannabis products vary widely in potency, formulation, and delivery methods, from flowers to edibles and concentrates to transdermal applications. Lack of standardized dosing guidelines worsens safety concerns.
Clinical Evidence of Medical Cannabis Efficacy	Cannabis shows strong evidence for chemotherapy-induced nausea and CBD for epilepsy, with moderate support for chronic pain and multiple sclerosis spasticity. However, there is limited evidence for PTSD, glaucoma, and inflammatory bowel diseases. Further research is needed on long-term safety, efficacy, and impacts on special populations.
Adverse Events of Cannabis Use	Cannabis use carries short-term cognitive risks and acute adverse effects, along with long-term associations with mood disorders, psychosis, dependence, and cardiovascular and respiratory issues. Further research is needed.
Federal-State Conflicts	Federal prohibition restricts funding and research, forcing states to navigate complex regulatory landscapes independently. Rescheduling cannabis could align policies and unlock research opportunities.

1.1 Purpose and Scope

This issue brief aims to:

- Evaluate the current state of Massachusetts's medical cannabis program, highlighting key successes and gaps.
- Identify evidence-based opportunities for improvement across areas such as public health education, equity in access, product safety standards, and research infrastructure.

- Offer policy considerations informed by best practices from other states, stakeholder insights, academic research, and emerging national and international trends.

This policy brief is structured as six key sections, each addressing critical aspects of the Massachusetts medical cannabis program within the broader federal landscape. Drawing on state-level data, stakeholder interviews, academic literature, national trends, and comparative insights from other state medical cannabis programs, the analysis presents evidence-based recommendations in the following areas:

- **Legal and Regulatory Framework:** Examines state laws and regulations governing medical cannabis, including compliance and oversight mechanisms.
- **Availability, Use, and Access to Medical Cannabis.** Assesses medical use trends and market dynamics to ensure equitable and affordable access.
- **Research and Surveillance.** Evaluates the current state of medical cannabis research in Massachusetts and the United States and the data collection and analysis infrastructure to strengthen evidence-based decision-making.
- **Public Health Education.** Reviews education initiatives to equip patients, providers, and the public with accurate, actionable information.
- **Product Quality and Testing**. Analyzes product testing and labeling standards to ensure safety and efficacy.
- **Potential Federal Rescheduling of Cannabis.** Examines the consideration to reclassify cannabis and implications for research, clinical integration, and state-federal policy alignment in Massachusetts.

This brief is intended for policymakers, health care providers, public health officials, researchers, MTCs, patient advocates, and health plans, as a roadmap for the Massachusetts medical cannabis program. It considers the potential implications of federal policy shifts, to provide actionable recommendations that will strengthen Massachusetts's medical cannabis program, improve patient care, and position the state as a leader in evidence-based cannabis policy. Our analysis underscores the interconnection of research, regulation, health care integration, and equity in developing a sustainable and effective medical cannabis framework.

1.2 The Federal Context of Medical Cannabis in the U.S.: A Changing Legal Landscape

Federal regulation shapes the legal and clinical environment of the Massachusetts medical cannabis program. Since 1970, cannabis has been classified as a Schedule I controlled substance under the Controlled Substances Act, indicating a high potential for abuse and no accepted medical use [27]. The designation has had significant consequences [1], including:

- **Hindered scientific research** due to restricted access to federally approved research-grade cannabis
- **Limited federal funding** for cannabis-related clinical studies

- **Fragmented regulatory oversight,** requiring states to develop independent frameworks to regulate cannabis

Despite federal restrictions, state-level reforms have grown markedly. California's 1996 legalization of medical cannabis led the way for thirty-eight states and the District of Columbia to establish such programs. As of 2023, more than 3.87 million Americans are registered medical cannabis patients—a number that continues to grow, along with interest in cannabis treatment [30].

1.3 Challenges in Medical Cannabis Regulation

The fragmented regulation of medical cannabis presents unique challenges for policymakers, health care providers, public health officials, and patients. Most challenges are rooted in misalignment between federal and state law and relate either to barriers to research and clinical evidence or to regulatory fragmentation [1, 6].

Barriers to Research and the Lack of Clinical Evidence

The clinical validation of medical cannabis is less established compared with that for traditional prescription medications. Unlike standard pharmaceuticals, cannabis has not been studied as extensively in large-scale randomized controlled trials (RCTs), making guidelines for dosing, efficacy, and safety less well-defined [5]. This gap in evidence is largely a result of cannabis's Schedule I classification under federal law. The classification imposes significant obstacles to research, including complex approval processes from federal agencies (such as the U.S> Drug Enforcement Administration [DEA] and the Food and Drug Administration [FDA]) limited federal funding, and restricted access to research-grade cannabis [34-36]. Research-grade cannabis often differs significantly from commercially available products, constraining efforts to conduct robust, clinically relevant studies [37, 38].

Drug Scheduling and Implications for Research

The Drug Enforcement Administration (DEA) classifies drugs, substances, and some chemicals used to make drugs into five categories, or schedules, according to a drug's accepted medical use and potential for abuse or dependency. Schedule I drugs have the highest potential for abuse and dependence and no currently accepted medical use, while Schedule V drugs have the least potential for abuse and dependence and are widely accepted for medical use. Schedule I drugs are subject to the most stringent federal restrictions, including limitations on human subjects research.

Source: DEA, U.S. Department of Justice [31]

Together, such obstacles delay research progress, create administrative burdens, and hinder the production of generalizable data necessary to inform evidence-based medical cannabis practices. Without standardized dosing protocols, efficacy data, or safety profiles, health care providers must rely on anecdotal evidence or trial-and-error approaches, facing uncertainty when recommending medical cannabis to patients [7-12, 14, 15, 39]. Patients, in

turn, face inconsistent guidance, often seeking information from dispensary staff or unverified sources rather than clinically validated recommendations [16, 18-20]. Public health officials, tasked with ensuring patient safety and equitable access, must operate with incomplete data, making it difficult to develop sound policies and oversight frameworks [40].

Regulatory Fragmentation and Federal-State Tensions

The regulatory landscape for medical cannabis in the United States is fragmented and inconsistent, reflecting ongoing conflict between federal prohibition and state-level reform efforts. In Massachusetts and other states, regulators have developed independent frameworks to govern product safety, potency limits, contaminant testing, labeling, and equitable access. However, these frameworks vary widely across states, creating inconsistencies in patient access, product quality, and safety protocols. This federal-state misalignment creates operational silos, preventing meaningful collaboration between states and limiting the development of cohesive national guidelines for safety, efficacy, and access.

Federal law prohibits health care providers from "prescribing" cannabis, allowing them only to "recommend" it under state medical cannabis programs. As a result, they must navigate a regulatory patchwork, which creates uncertainty around compliance and legal exposure. Patients, meanwhile, face variation in product quality, safety standards, and availability, depending on where they seek treatment.

Recent federal developments signal a potential shift with implications for the Massachusetts medical cannabis program. In 2023, HHS recommended reclassifying cannabis from a Schedule I to a Schedule III substance under the Controlled Substances Act [28]. Schedule III substances are recognized for their accepted medical uses and lower potential for dependence and abuse and include medications such as ketamine and anabolic steroids [27]. If enacted, the reclassification may reduce barriers to research, streamline clinical guidelines, and create greater alignment between federal and state policies, ultimately supporting a more cohesive and evidence-based approach to medical cannabis regulation.

Exhibit 2. Limitations Related to Cannabis Scheduling and Regulatory Misalignment

Limitations Related to Schedule I Classification
• Cannabis is classified as a Schedule I controlled substance, alongside heroin and LSD, creating significant barriers to research **[1].** • Researchers face stringent DEA approvals, complex security requirements, and limited access to federally approved cannabis suppliers. • For decades, research-grade cannabis was available only through the University of Mississippi, limiting the scope, diversity, and quality of scientific studies **[32]**. • New growers have been approved recently for research purposes. However, progress has been slow, leaving clinicians and policymakers with insufficient data on dosing, safety, and efficacy.
Limitations Related to Regulatory Misalignment
• Physicians can only "recommend" cannabis under state medical programs, as federal law prohibits prescriptions. • Misalignment between federal and state law means that states like Massachusetts must create independent frameworks, often in conflict with federal regulations.

1.4 The State of Medical Cannabis Research

Despite challenges posed by regulatory barriers and limited research, evidence supporting the therapeutic potential of medical cannabis continues to grow, despite challenges posed by regulatory barriers and limited research. While knowledge gaps persist, emerging studies provide insights into its efficacy and therapeutic potential for specific conditions. This section presents an overview of medical cannabis research and policy considerations. Our review is not comprehensive or a formal meta-analysis. The literature search included combinations of terms such as “Cannabis” or “Cannabinoid”, “Medical Cannabis”, “Medical Marijuana”, “Marijuana”, and “Pharmaceutical Cannabis”, with priority given to research published in the past decade.

Cannabinoids

Cannabis contains over 100 active cannabinoids, with delta-9-tetrahydrocannabinol (THC) and cannabidiol (CBD) the most prominent [33-36]. The compounds have distinct pharmacological effects that influence their therapeutic applications:

- **THC**—the primary psychoactive component—is used for chronic pain management, nausea relief, and appetite stimulation. However, its use carries risks, including addiction potential, anxiety, and psychosis [37-39].
- **CBD**—a non-psychoactive compound—has demonstrated anti-inflammatory, anticonvulsant, and potential antipsychotic properties. It is FDA-approved for treating epilepsy, but its efficacy for other conditions requires further research [40].

The therapeutic efficacy of cannabis products is influenced by both the concentration and ratio of cannabinoids, particularly the balance between THC and CBD [39]. Evidence suggests that CBD may mitigate some of THC's psychoactive effects. For this reason, CBD may be used in tailored formulations that reduce adverse effects while maximizing therapeutic benefits for specific conditions [41] **(Exhibit 3).**

Exhibit 3. Overview of Cannabinoids

- Non-psychoactive substance
- FDA-approved for epilepsy treatment
- Anti-anxiety and anti-psychotic properties

- Psychoactive substance
- FDA-approved to treat chemotherapy-induced nausea and cachexia
- Potential for addiction

Cannabis products are often categorized as THC-dominant, CBD-dominant, or hybrid (balanced THC/CBD). Products range from flower, lotions to oral pills. Upon consumption, THC and CBD enter the bloodstream through the lungs, mouth, or skin, reaching the brain and other organs.

NOTES: CBD=cannabidiol; THC= delta-9-tetrahydrocannabinol.
SOURCES: Developed by NORC based on Carliner et at, (2017) [37]; Elsohly & Slade (2005) [38]; Huestis (2007) [39]; and FDA Regulation of Cannabis and Cannabis- Derived Products [40].

Efficacy of Cannabis-Based Medicines

Cannabis-based medicines, particularly formulations with THC and CBD, have been explored for their therapeutic potential across medical conditions **(Exhibit 4)**. The strength of evidence varies by condition **(Exhibit 5)**.

Exhibit 3. Cannabis or Cannabinoids Used for Medical Purposes

Category	Product Name	Composition
Medical Products with Marketing Authorization 	**Cesamet (Nabilone)**	Synthetic cannabinoid similar to THC
	Marinol, Syndros (Dronabinol)	Synthetic THC
	Sativex (Nabiximols)	Plant-based THC and CBD
	Epidiolex	Plant-derived CBD (oral solution)
Cannabis-Based Products 	**Standardized Cannabis-Based Medical Products**	Variable THC-CBD composition
	Raw Cannabis	Unprocessed cannabis flower or extract

NOTES: CBD=cannabidiol; THC= delta-9-tetrahydrocannabinol.
SOURCES: Adapted from EMCDDA "Medical use of cannabis and cannabinoids: questions and answers for policymaking" [42] ; and FDA questionnaire [40, 42].

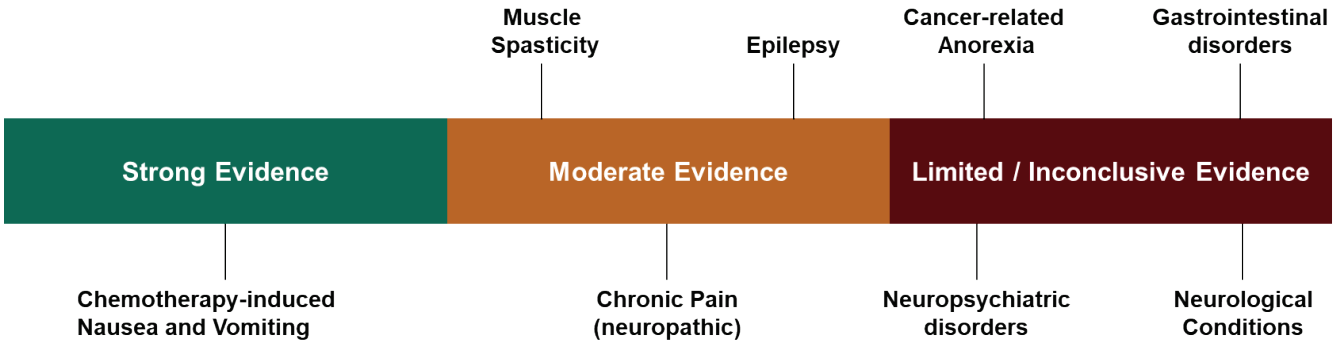
The strongest evidence for cannabis-based medicines exists for treatment of chemotherapy-induced nausea and vomiting (CINV) [1]. Synthetic THC analogs such as dronabinol, nabilone, and nabiximols have demonstrated superior antiemetic effects compared with placebo and conventional antiemetics, although newer antiemetic agents may offer comparable or superior efficacy [43-47]. Their efficacy in other forms of chronic non-cancer pain remains inconsistent, with patient-perceived benefits varying widely [48]. Most clinical trials have been limited in duration, often lasting fewer than 12 weeks, and cannabinoids are typically prescribed as adjunct therapies rather than primary analgesics [49-51]. Due to the development of tolerance over time, cannabinoids are recommended as second- or third-line treatments in chronic pain management [52]. Additionally, some evidence suggests potential benefits for sleep disturbances in patients with chronic pain, though the magnitude of this benefit is small [53].

For multiple sclerosis (MS), studies suggest that nabiximols, dronabinol, and THC/CBD formulations provide some relief from muscle spasticity-related symptoms. Patient-reported improvements often exceed physician-assessed outcomes [54, 55]. However, treatment discontinuation due to adverse events is a concern [56]. Current guidelines recommend cannabinoids for MS-related spasticity only when other treatments are ineffective, with a four-week trial period advised to assess therapeutic benefit [57]. For epilepsy, CBD-based formulations such as Epidiolex have been approved to treat intractable seizures associated with Lennox-Gastaut syndrome, Dravet syndrome, and tuberous

sclerosis complex. Meta-analyses suggest that CBD is moderately effective as a stand-alone or adjunct therapy, particularly in cases resistant to standard antiseizure medications [58].

The evidence is inconclusive for a range of other conditions. Despite theoretical interest in cannabinoids for neuropsychiatric disorders, the limited number of rigorous studies pose challenges for deriving firm conclusions. Preliminary investigations have explored cannabis-based treatments for schizophrenia, bipolar disorder, post-traumatic stress disorder, Tourette's syndrome, autism spectrum disorder, and dementia, but the findings are inconsistent and these treatments generally lack approval by regulatory agencies [59-64]. Similarly, cannabinoids have been tested in various gastrointestinal disorders, including Crohn's disease and ulcerative colitis, but available RCTs have not demonstrated consistent clinical benefits [65-67]. For appetite stimulation in cancer-related anorexia-cachexia syndrome, cannabinoid treatments have not significantly improved appetite, oral intake, or quality of life [68]. Likewise, while cannabinoids have been explored for conditions such as Parkinson's disease, Huntington's chorea, dystonia, and multiple sclerosis-related tremors, the evidence is mixed, with some studies failing to show efficacy [69-71]. There is great interest in the potential for cannabinoids to reduce opioid use and some promising real-world data, but to date, results from high-quality studies have not been promising [72].

Exhibit 5. Medical Cannabis: Evidence of Clinical Efficacy



SOURCES: Developed by NORC based on a review of peer-reviewed literature cited in the "Efficacy of Cannabis-Based Medicines" section. The full list of references is available in that section.

Adverse Effects

Cannabis-based medicines may offer therapeutic benefits, but their use carries risks. Short-term adverse effects of THC-based cannabis medicines are common but generally mild, with dizziness, sedation, and cognitive impairment being the most frequently reported [3, 73]. Fewer safety concerns are associated with CBD, although potential liver toxicity and drug-drug interactions require further scrutiny [74, 75]. Additionally, studies estimate that up to 25% of individuals using medicinal cannabis may develop cannabis use disorder (CUD), with higher risks among those with chronic pain or comorbid mental health conditions [76]. While cannabis-based medicines may be obtained through regulated sources under medical supervision, many individuals use cannabis recreationally or as a form

of self-medication. Such use presents additional risks due to variability in product composition and potency, as well as lack of clinical oversight.

Acute cannabis intoxication can lead to a range of neuropsychiatric effects, including euphoria and relaxation at lower doses and at higher doses, anxiety, paranoia, irritability, and perceptual disturbances such as hallucinations, delusions, and depersonalization [77, 78]. Motor impairment following cannabis use is particularly concerning, as it significantly increases the risk of traffic accidents [79]. Unlike with alcohol consumption, the amount of THC that enters the bloodstream varies widely, complicating the determination of impairment thresholds [80]. Cognitive impairments are also evident, with acute cannabis use leading to deficits in verbal memory, attention, learning, and psychomotor function [81, 82].

Chronic cannabis use is associated with an increased risk of mood and anxiety disorders. Heavy use is linked to a higher incidence of major depression, with risk estimates indicating a twofold increase among cannabis misusers and a three- to five-fold increase among individuals diagnosed with CUD [83]. Additionally, cannabis use has been correlated with heightened anxiety symptoms, particularly during withdrawal [83-85]. Among the most significant psychiatric concerns is the well-established association between cannabis use and psychotic disorders [86]. Meta-analyses indicate a dose-response relationship, with daily cannabis users facing a five-fold increased risk of developing psychosis, particularly when consuming high-potency cannabis [87, 88]. Longitudinal studies further suggest that cannabis use may contribute to schizophrenia, with estimates indicating that cannabis use accounts for approximately 30% of schizophrenia cases among young males [89]. Genetic research supports a causal link between cannabis and schizophrenia, while clinical evidence shows that cannabis use exacerbates symptoms in individuals with pre-existing psychotic disorders, leading to higher relapse rates and longer psychiatric hospitalizations [90-92].

Cannabis dependence is a concern, with approximately 22% of lifetime users meeting the criteria for CUD, a prevalence that rises to 33% among daily or near-daily users [93]. Symptoms of CUD include compulsive use, cravings, tolerance, and withdrawal effects [78]. Beyond psychiatric concerns, cannabis use is associated with physiological risks. Use during pregnancy has been linked to increased risks of maternal anemia, low birth weight, and neonatal intensive care unit admissions [94]. Regular cannabis smoking is associated with respiratory symptoms such as chronic bronchitis, wheezing, and cough, though evidence linking cannabis to lung cancer remains inconclusive due to confounding tobacco use [95, 96] Cannabis vaping has been implicated in e-cigarette or vaping product use-associated lung injury (EVALI) [97].

Cardiovascular risks include greater incidence of myocardial infarction, tachycardia, arrhythmias, and hypotension [98-100]. Further, chronic cannabis use has been linked to cannabis-induced hyperemesis syndrome (CHS), a condition characterized by cyclical episodes of severe nausea, vomiting, and abdominal pain [101]. Neurological studies indicate that chronic cannabis use may lead to structural and functional brain changes, including reductions in hippocampal and orbitofrontal cortex volumes—regions involved with memory, learning, and motivation. Alterations in reward-processing networks have been observed, particularly among heavy users [102]. The rising potency of cannabis products

worsens concerns regarding dependence, cognitive impairment, and mental health risks, particularly among youth and vulnerable populations [21].

Current Gaps in Evidence Synthesis

Despite growing clinical interest, there are significant research gaps that limit the development of evidence-based policies and treatment guidelines. A recent systematic review highlighted key challenges in synthesizing research findings [103]:

- **Product Diversity.** Insufficient research exists on how product-specific dimensions, such as dosage, potency, administration methods, and cannabinoid composition affect treatment outcomes. This limits the generalizability of findings and the development of standardized treatment guidelines.
- **Inconsistencies in Study Design.** Variability in the characteristics and composition of medical cannabis products used in studies creates significant challenges in synthesizing data.
- **Need for Standardization.** The lack of alignment across clinical trials limits the ability to draw meaningful conclusions or to conduct subgroup analyses.

These gaps pose challenges for health care providers, reinforcing the need for expanded clinical research, standardized formulations, and real-world patient data to guide cannabis-based medical interventions.

1.5 Medical Cannabis Product Variability, Methods of Consumption, and Dosing Challenges

Cannabis can be consumed through a variety of delivery methods, including smoking, vaporizing, oral ingestion (for example, edibles), topical creams, and sublingual applications (**Exhibit 6**). Recent innovations, mainly in adult-use markets, have added high-potency concentrates, edible formulations, and transdermal applications, making research, clinical care, and patient education more complex.

The method of consumption significantly influences the absorption, metabolism, and overall effects of cannabinoids. Each approach shows a unique pharmacokinetic profile **(Attachment 3)**. For example:

- **Smoking and vaporizing** provide rapid onset but shorter-lasting effects [104, 105].
- **Edibles** offer prolonged effects and are associated with delayed onset, which can lead to accidental overconsumption [104, 106].
- **Topicals and transdermals** offer localized relief but vary widely in absorption efficiency, depending on formulation and skin permeability [39].

Exhibit 6. Examples of Medical Cannabis Products

NOTES: Top left quadrant: cannabis edibles. Top right: cannabis topicals/lotions. Bottom left: cannabis vape oils. Bottom right: cannabis flowers, rolled cannabis.
SOURCES: Iconfinder - [Search Term: "THC CBD Icons," Accessed January 2024]; Shutterstock - [Search Term: "THC CBD Icons," Accessed January 2024]

Dosing Challenges

Accurate dosing is a challenge in medical cannabis care, stemming from the plant's complex pharmacology and the variability in patient metabolism. Conventional pharmaceuticals use standardized dosing guidelines established through rigorous clinical trials, while medical cannabis lacks comprehensive clinical research to inform precise dosing recommendations. The absence of well-defined standards reflects limited industry investment in large-scale trials, as the changing landscape of cannabis legalization reduces incentives for pharmaceutical companies to finance research that meets the "gold standard" of RCTs for qualifying medical conditions. The pharmaceutical industry has restricted its development efforts to approved formulations such as nabiximols, nabilone, and dronabinol [5]. As a result, clear guidelines for effective dosages, product typologies, and medical conditions for which cannabis-based products demonstrate proven efficacy remain less established than for traditional pharmaceuticals. Some advocates propose relying on real-world evidence and patient-reported outcomes—akin to pharmacovigilance data—to guide dosing recommendations, especially for patients who use a range of cannabis-based products for medical purposes [5, 107].

Product variability further complicates dosing, with formulations differing widely in potency, cannabinoid composition, and delivery methods. The delayed onset of orally ingested cannabis, particularly in edibles, means that effects may take hours to manifest and may vary significantly depending on an individual's metabolism and gastrointestinal absorption. Inhaled cannabis offers more immediate effects but is subject to inconsistencies in inhalation techniques and lung absorption efficiency [108].

The National Institute on Drug Abuse (NIDA) has proposed a standard unit of THC at 5 mg per dose as a benchmark for clinical research and practical dosing guidance [109]. Experts recommend that standard cannabis units be defined based on the quantity of THC, the primary intoxicating component [110]. This approach could enhance dose standardization for medicinal cannabis use, improving comparability across studies and guiding clinical applications. However, this approach is a blunt instrument that does not account for individual patient tolerance, genetic variations in cannabinoid metabolism, and the diverse pharmacokinetics associated with different product types and delivery methods. Additionally, interactions between THC and other cannabinoids, such as CBD, further complicate dosing, as CBD can modulate THC's effects, influencing both therapeutic outcomes and side-effect profiles [39].

Without standardized, evidence-based dosing protocols, patients risk overconsumption, suboptimal treatment outcomes, and adverse effects [111]. Addressing these challenges requires robust clinical trials, standardized product formulations, and enhanced public health education for patients, health care providers, and MTC staff. Further research is needed to refine dosing strategies, balancing scientific rigor with real-world patient experiences to optimize therapeutic outcomes while minimizing potential harms.

1.6 Impacts on Health Care Systems and Policy

The increasing use of medical cannabis presents unique challenges for health care systems, particularly in clinical decision-making and patient care [7, 112]. Health care providers face increasing pressure to:

- Navigate complex clinical decisions about medical cannabis products
- Address patient inquiries about safety, efficacy, and dosing
- Balance potential therapeutic benefits with associated risks

To support providers in meeting these demands, evidence-based clinical guidelines are urgently needed to establish clear protocols for cannabis recommendations. Similarly, policymakers, insurers, and health care organizations also require robust evidence to:

- Assess the risks and benefits of medical cannabis products
- Adapt regulatory frameworks to address emerging trends and challenges

However, the rapid pace of cannabis legalization has outstripped scientific research, creating barriers to ensuring the safe, effective, and equitable use of medical cannabis. Moving forward, Massachusetts

must align policy development, clinical practice, and patient education with the best available evidence for cannabis research.

1.7 Conclusion: A Foundation for Action

The Massachusetts medical cannabis program faces both state-specific challenges and broader federal constraints, particularly related to the long-standing Schedule I classification under the Controlled Substances Act. This designation continues to impede research, limit funding, and complicate regulatory alignment. As Massachusetts refines its regulatory framework, it must address state-level issues such as changing product trends, fragmented oversight, and the need for comprehensive clinical guidelines.

Anticipated policy shifts related to HHS's recommendation to reclassify cannabis as a Schedule III substance signal a transformative moment for medical cannabis policy nationwide. If enacted, this change may reduce barriers to research, provide clearer clinical guidelines, and align federal and state regulations. For Massachusetts, such changes are an opportunity to enhance the medical cannabis program, ensuring that it is patient-focused, evidence-driven, and adaptable to future advancements.

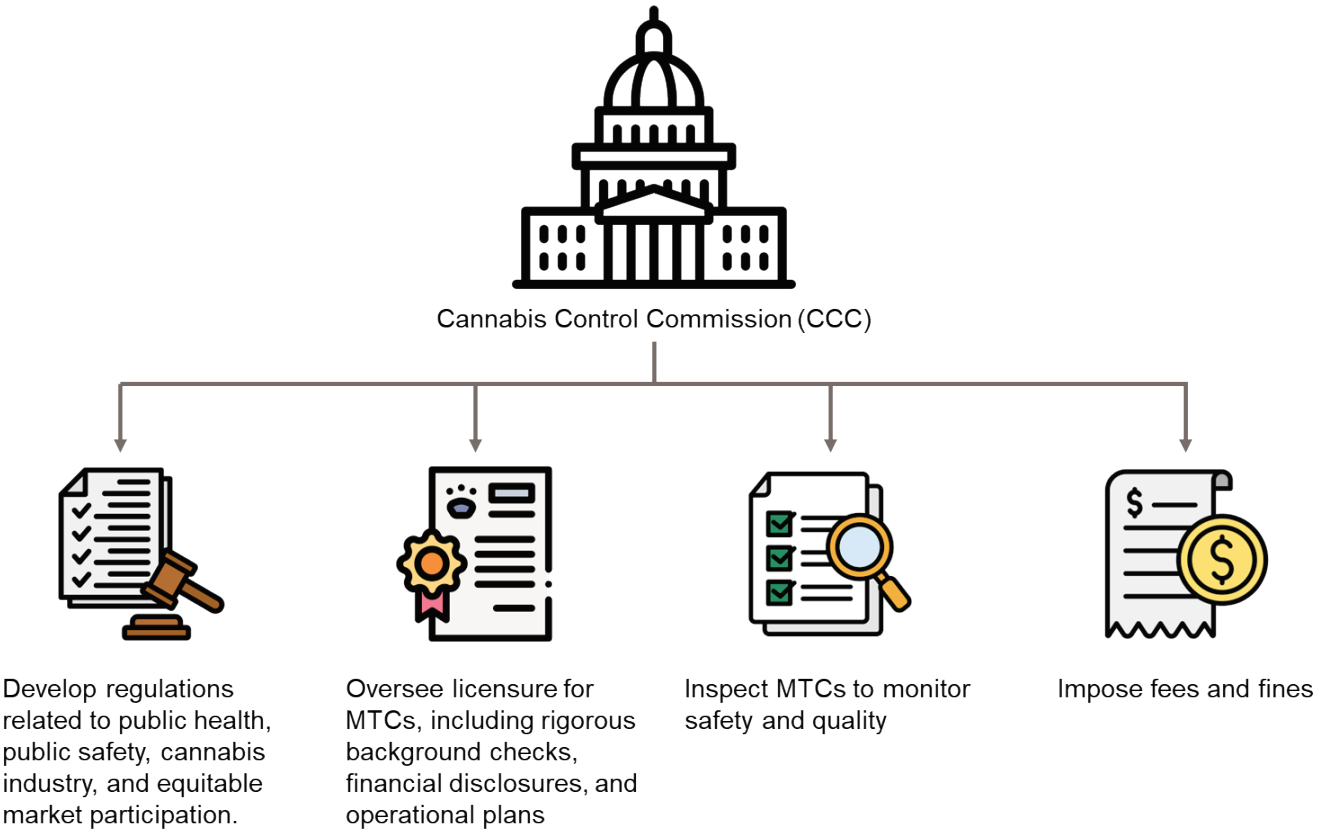
2. Legal and Regulatory Framework

2.1 Evolution of the Massachusetts Cannabis Program

Massachusetts's cannabis policy reform began with the 2008 Massachusetts Sensible Marijuana Policy Initiative, which decriminalized possession of small amounts of cannabis. Decriminalization transformed cannabis possession from a criminal offense to a civil infraction with a fine, establishing the basis for legislative reforms.

In 2012, the state legalized medical cannabis through the Massachusetts Medical Marijuana Initiative, becoming the 18th state to do so. The legislation established a framework for medical cannabis regulation under licensed health care providers, designating MTCs as the primary distribution point for patients. Legalization of adult-use cannabis followed in 2016 with the passage of the Massachusetts Marijuana Legalization Initiative. This law allowed adult possession of cannabis and began the development of a regulated commercial market. Initially, the Department of Public Health (DPH) oversaw medical cannabis operations. However, in 2017, the newly created Massachusetts CCC assumed regulatory authority over both medical and adult-use cannabis markets to streamline oversight. The CCC issued its first provisional licenses for adult-use cannabis businesses in mid-2018, with commercial sales beginning later that year. Once the CCC assumed regulatory oversight, application processes were streamlined and digitized, licensing fees were reduced, and state-regulated seed-to-sale tracking systems required for inventory management [24, 113]. As an independent agency, the CCC's primary role is focused on licensing, compliance, and market regulation.

Exhibit 7. The Role of The Massachusetts Cannabis Control Commission



Notes: Developed by NORC based on the Massachusetts Cannabis Control Commission [114]

In this brief, we use the term MTCs to refer to medical cannabis facilities, which serve registered medical cannabis patients. The term “dispensaries” will refer exclusively to adult-use cannabis establishments that sell to adults aged 21 and over for recreational purposes.

2.2 Equity-Driven Regulatory Updates

In 2022, Chapter 180 of the Acts of 2022—An Act Relative to Equity in the Cannabis Industry—introduced measures to enhance regulatory oversight and promote equitable access to cannabis businesses and products. The Chapter focuses on industry-level reforms, such as licensing processes, fee structures, and business development, but does not directly address patient care or clinical considerations. In October 2023, the CCC implemented updates to align with the equity-focused objectives of Chapter 180, facilitating greater participation among historically marginalized entrepreneurs in the cannabis industry [113, 114].

Exhibit 8. Key Legislative Milestones

Year	Legislative Milestone	Description
2012	Massachusetts Medical Marijuana Initiative	Legalized medical cannabis for patients with qualifying conditions; established the framework for MTCs as primary distribution points for patients.
2013	Implementation of Medical Use of Marijuana Program	DPH began overseeing patient, caregiver registration and licensing of Registered Marijuana Dispensaries (RMDs).[1]
2015	First RMDs Open	First RMDs began operating. Patients gained legal access to medical cannabis under DPH regulation.
2017	Establishment of the CCC	Established to regulate both medical and adult-use cannabis.
2018	Adult-Use Cannabis Legalization and Sales Commence	Recreational sales commenced following 2016 voter approval.
2023	Regulatory Updates Promulgated Under Chapter 180	Chapter 180 introduced equity-focused policies, including host community agreement reforms.

NOTE: [1]Under the Department of Public Health (DPH), medical cannabis facilities were referred to as Registered Marijuana Dispensaries (RMDs). With the transition to the Cannabis Control Commission (CCC), the facilities became known as Medical Treatment Centers (MTCs). The term dispensaries now refers exclusively to adult-use cannabis establishments that serve recreational consumers aged 21 and over.
SOURCE: Massachusetts Cannabis Control Commission.

3. Availability, Use, and Access to Medical Cannabis

Massachusetts has expanded access to medical cannabis through MTCs and regulatory developments, yet barriers remain. This section examines key factors influencing availability, use, and access, including patient enrollment in the medical program, geographic distribution, and affordability (**Exhibit 9**). It also explores policy approaches from other states to identify strategies to improve equitable access and sustaining patient participation.

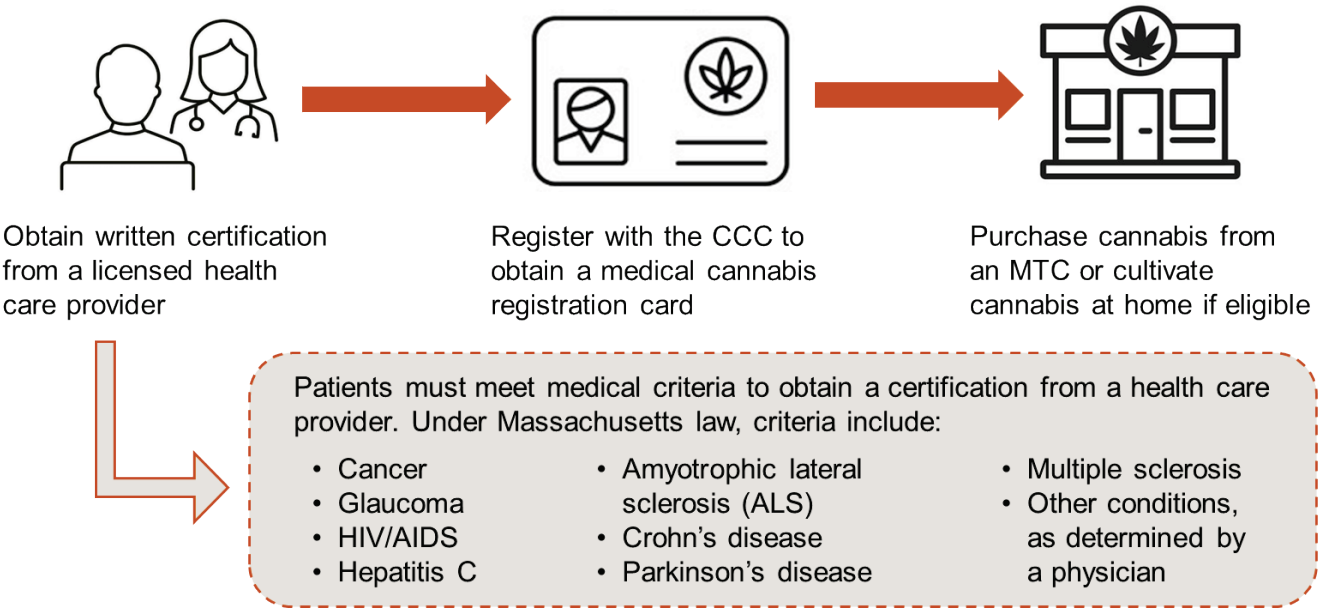
Exhibit 9. Key Insights: Barriers to Medical Cannabis Availability, Use, and Access

Domain	Key Insight
Access to Medical Cannabis	The number of MTCs in Massachusetts has grown steadily, but growth has been outpaced by the rapid expansion of dispensaries since 2019, raising concerns about equitable access for medical patients.
Medical Cannabis Utilization	Active patient registrations increased sharply between 2019 and 2020 but have since plateaued and gradually declined, showing potential barriers to sustained patient participation in the medical program.
Geographic Disparities	Rural and underserved urban areas face limited access to MTCs. Long travel distances and sparse delivery services create significant access barriers for patients.
Telehealth and Mobile Access	Telehealth services and mobile MTCs have improved access for some patients but remain limited in scope and impact.
Affordability Challenges	The high cost of medical cannabis, combined with a lack of insurance coverage, may prevent many patients from maintaining consistent medical cannabis treatment.

3.1 Medical Cannabis Access

Patients must undergo a structured certification and registration process to access medical cannabis. First, a Certifying Health Care Provider must issue a written recommendation confirming that the patient has a qualifying medical condition. Once a patient receives certification, they are given a Personal Identification Number (PIN), which allows them to register as an active patient through the Medical Use of Marijuana Program Online System. There is no registration fee for patients, removing a potential financial barrier to participation. Once registration is complete, patients gain authorization to purchase medical cannabis products from licensed MTCs [113, 114] **(Exhibit 10)**.

Exhibit 10. Medical Cannabis Patient Registration Process and Qualifying Health Conditions



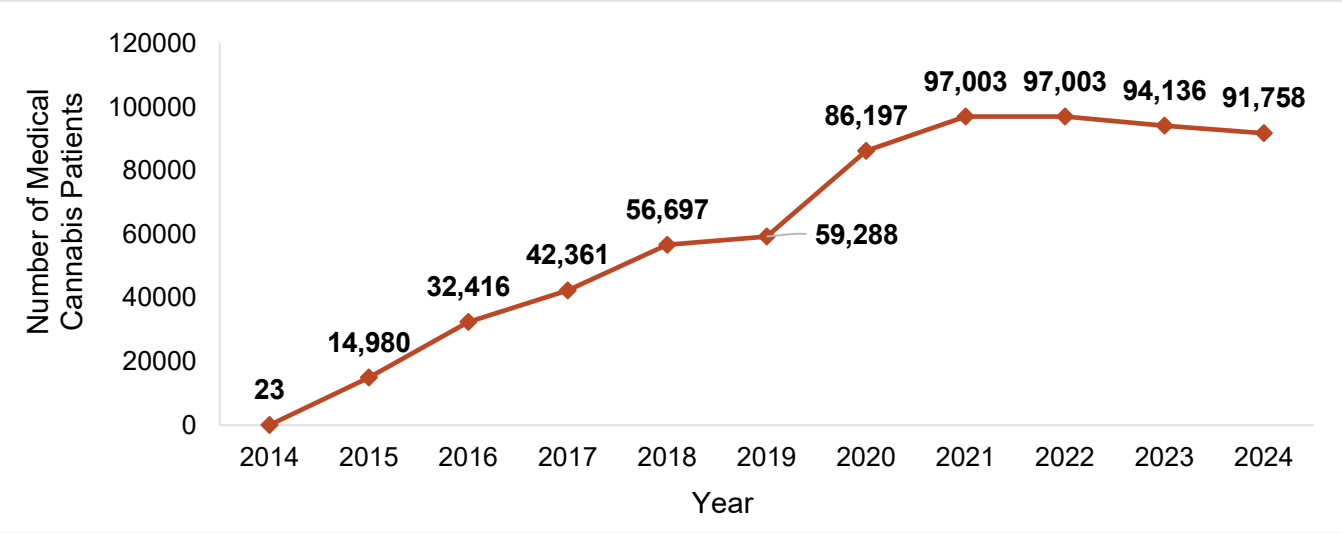
SOURCE: Massachusetts Cannabis Control Commission, Massachusetts Cannabis Information [115]

The MTCs are responsible for cultivating, processing, and retailing medical cannabis, serving as the foundation of Massachusetts's distribution system. These businesses operate under a vertically integrated model, meaning that each MTC controls the entire supply chain—from cultivation and product manufacturing to retail sales [113, 114]. The structure was designed to ensure consistency in product quality, to enhance patient safety, and to maintain regulatory oversight by requiring MTCs to manage all aspects of production and distribution.

3.2 Overview of Medical Cannabis Trends

As of July 2024, Massachusetts had 91,758 actively registered medical cannabis patients. Patient enrollment increased steadily from 2014 to 2021, peaking between 2019 and 2020 before stabilizing at 97,003 (2022) and then gradually declining **(Exhibit 11)**. In DTP:2023, the state reported over 97,000 certified patients, representing 1.35% of the population—the 18th highest proportion in the United States [30]. Massachusetts also ranked 14th nationally in total medical cannabis registrations [116].

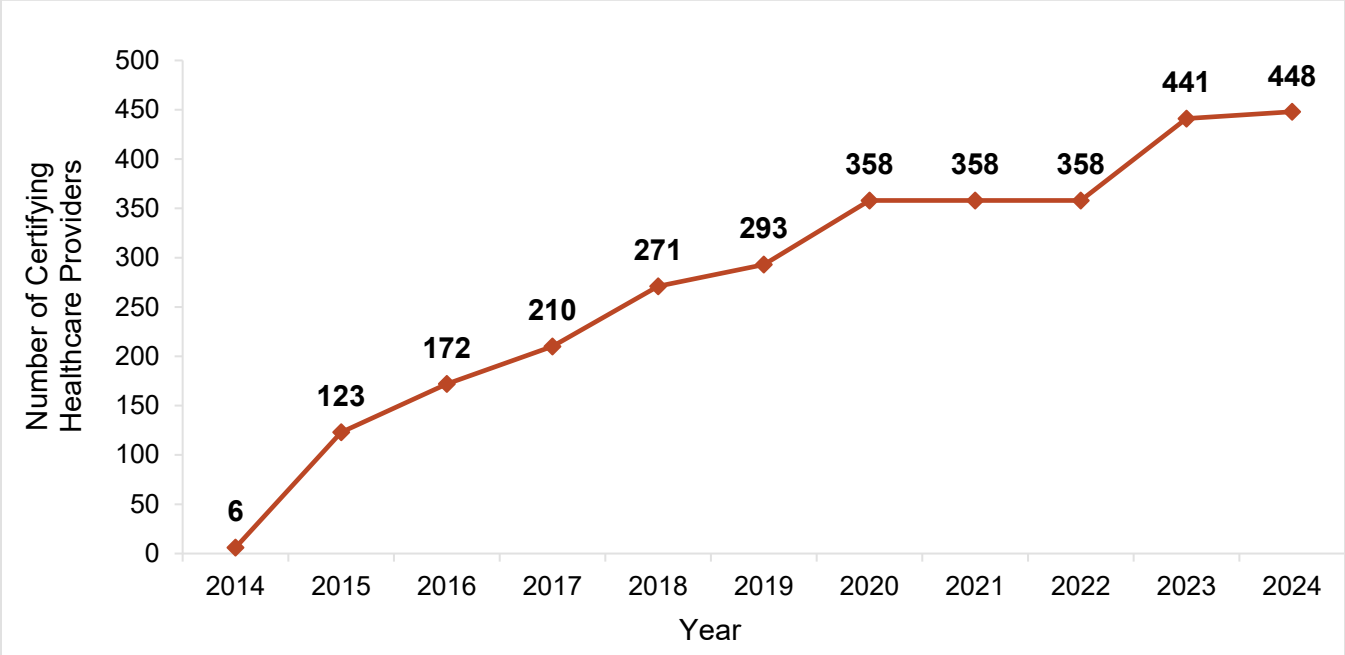
Exhibit 11. Number of Active Medical Cannabis Patients in Massachusetts, 2014–2024



SOURCE: Massachusetts Cannabis Control Commission, Open Data Catalog, (Accessed January 2024) [25] Massachusetts Department of Public Health, Medical Use of Marijuana Monthly Dashboards, (Accessed January 2024) [117]

Massachusetts has seen growth in the availability of providers—including physicians, nurse practitioners, and physician assistants—authorized to certify medical cannabis use. Between 2014 and 2020, there was consistent growth in the number of Certifying Health Care Providers before plateauing at 358 providers statewide (2020–2022). There was a sharp increase between 2022 and 2023, then a modest rise from 2023 to 2024 [115] **(Exhibit 12).**

Exhibit 12. Number of Certifying Health Care Providers in Massachusetts, 2014-2024

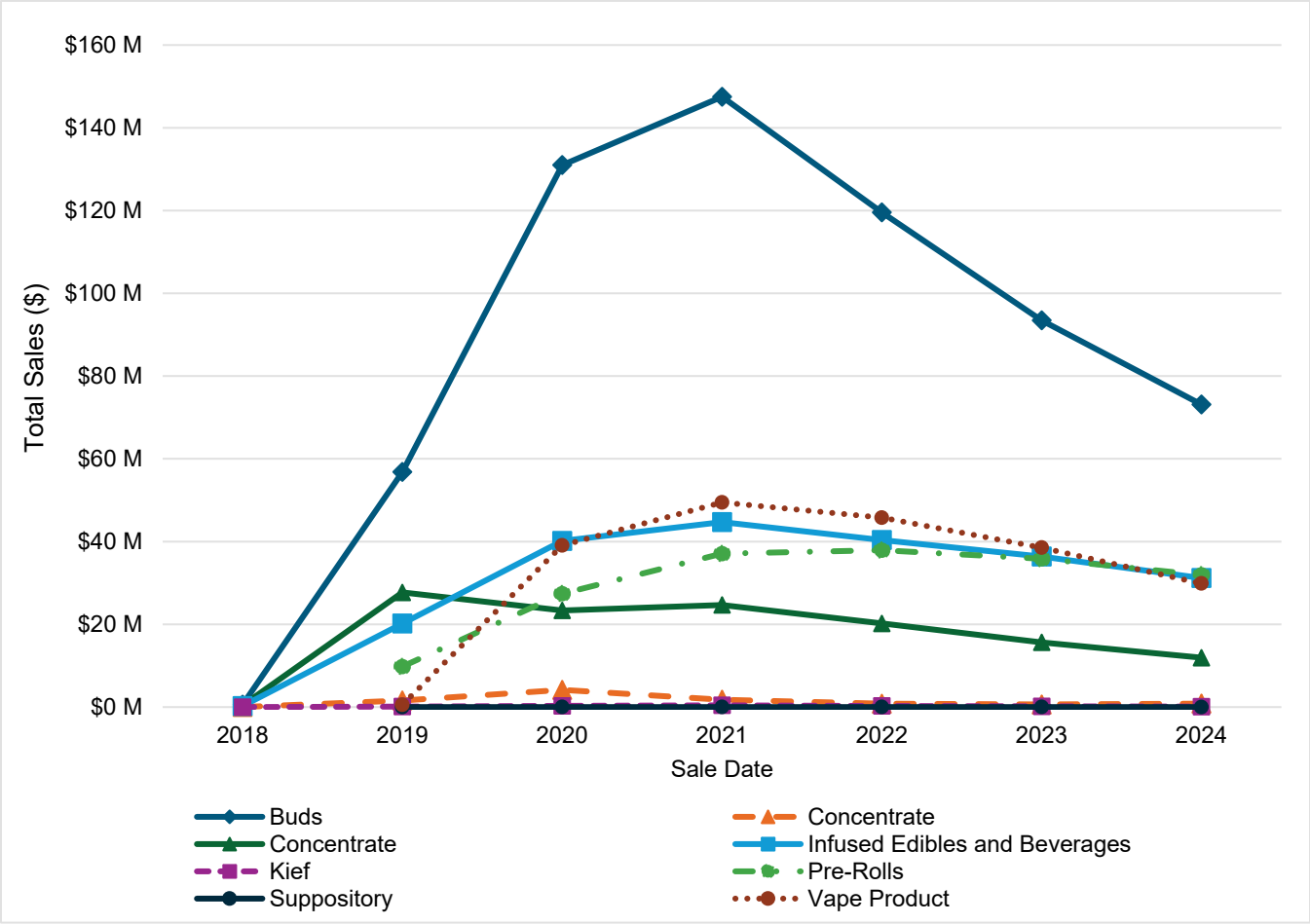


SOURCE: Massachusetts Cannabis Control Commission, Open Data Catalog, (Accessed January 2024) [25]; Massachusetts Department of Public Health, Medical Use of Marijuana Monthly Dashboards, (Accessed January 2024) [117]

Trends in Medical Cannabis Product Consumption

From November 2018 to December 2024, medical cannabis sales data showed consistent product preferences. Cannabis flower remains the dominant product, while edibles and concentrates have grown in market share, particularly since 2020. Infused non-edibles are a smaller category yet have maintained consistent sales. Several peaks, notably in late 2021 and early 2023, suggest fluctuations in purchasing behavior that may have been linked to external market dynamics [118] **(Exhibit 13)**. There are seasonal variations across product categories, with increased sales during specific months.

Exhibit 13. Sales by Product Type for the Medical-Use Market



SOURCE: Massachusetts Cannabis Control Commission, Open Data Catalog, (Accessed January 2024) [25]

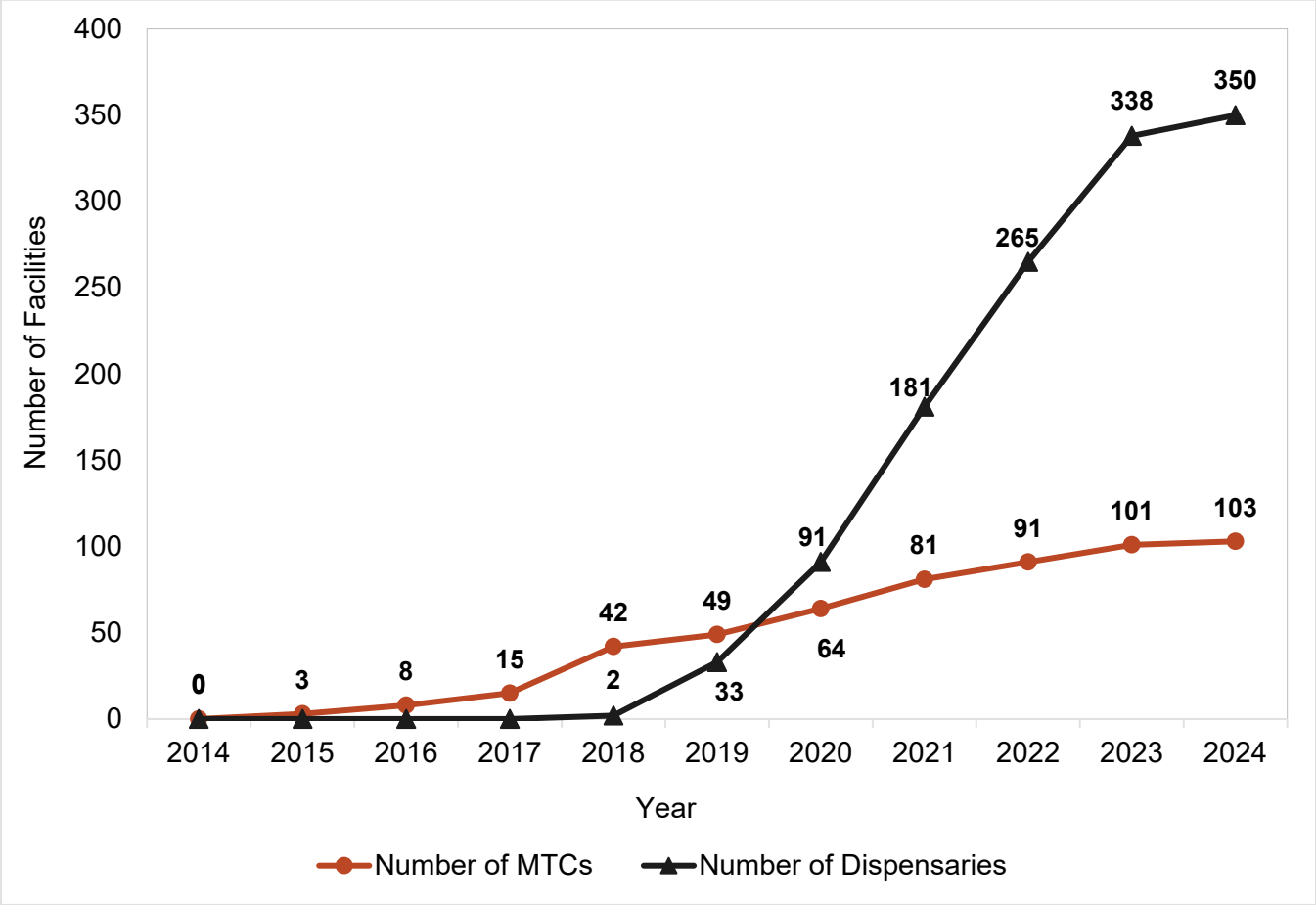
Comparing Medical and Adult-Use Cannabis Markets in Massachusetts

The medical and adult-use cannabis markets in Massachusetts show substantial differences in sales volume and market size, reflecting differences in consumer behavior, regulatory structures, and access pathways. Since adult-use dispensaries launched in November 2018, the sector has generated $6.34 billion in gross sales as of June 30, 2024, compared with $1.3 billion in medical cannabis sales. In 2023

alone, medical cannabis sales totaled $225 million, while adult-use dispensaries generated $1.27 billion between January and October—nearly six times the revenue of the medical market. This trend continues into 2024, with adult-use sales reaching $799.7 million in the first six months, compared with $98.2 million in medical cannabis sales [25, 118]. This sharp contrast underscores key structural differences between the two markets. While the medical program serves registered patients seeking cannabis for therapeutic purposes, the adult-use market attracts a broader consumer base with fewer regulatory and enrollment barriers.

As of December 2024, there were 103 licensed MTCs in Massachusetts, reflecting steady growth since the program's start. The most significant expansion occurred between 2017 and 2018. In contrast, since the first two dispensaries opened in November 2018, the number of dispensaries has grown to 350 (as of April 2024). Starting in 2019, the number of dispensaries has expanded more rapidly than MTCs. [118] **(Exhibit 14)**.

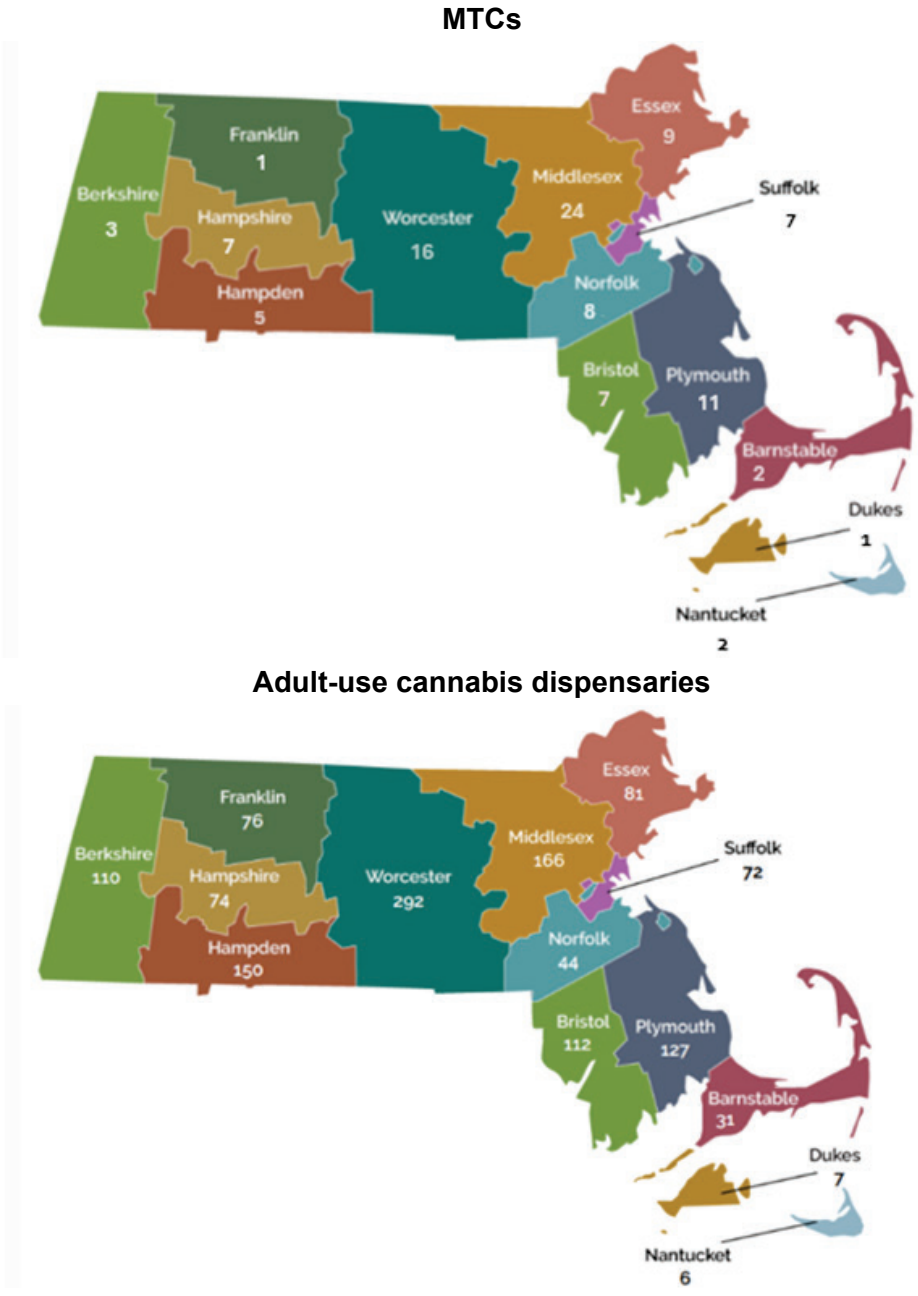
Exhibit 14. Number of MTCs Compared to the Number of Dispensaries, 2014–2024



SOURCE: Massachusetts Cannabis Control Commission, Open Data Catalog, (Accessed January 2024) [25]

Additionally, there are differences in geographic distribution between the locations of MTCs and those of dispensaries [25] **(Exhibit 15)**.

Exhibit 15. Number of MTCs Compared with the Number of Dispensaries, April 2024



SOURCE: Massachusetts Cannabis Control Commission, Open Data Catalog, (Accessed January 2024) [25]

3.3 Health Equity Considerations in Access and Utilization

Achieving health equity in cannabis policy requires ensuring that all individuals, regardless of socioeconomic status or geographic location, have access to safe, affordable, and reliable cannabis products for therapeutic use. Massachusetts has made progress in regulating medical cannabis, but barriers remain in two key areas, related to geographic disparities and socioeconomic status.

Geographic Disparities

The number of MTCs has grown, but geographic barriers remain. Approximately 13% of cannabis consumers report avoiding legal purchases due to the distance to dispensaries [119]. Stakeholder interviews highlighted that patients in rural and underserved urban areas often face long travel distances, increased transportation costs, and logistic challenges when accessing medical cannabis. Such barriers can lead patients to rely on adult-use dispensaries, where products may be taxed and not specifically tailored to meet their therapeutic needs [26, 120].

Massachusetts has implemented measures to address geographic disparities in medical cannabis access, such as aligning MTC licensing fees with those of dispensaries to prevent market erosion. Additionally, telehealth policies introduced on December 29, 2022 improve access for residents in remote areas, allowing registered patients to seek both initial certification and renewal appointments remotely, provided their health care provider has obtained the necessary waiver [121]. Further, the state has launched mobile MTCs in select regions and mail-order delivery systems for medical cannabis, offering a more flexible model for reaching underserved populations [122]. However, efforts are limited in scope and do not address the full extent of geographic disparities across the state.

Beyond direct patient-focused initiatives, recent industry reforms may have indirect benefits for medical cannabis access. The CCC's 2023 regulatory updates focusing on health equity—including fee reductions and expedited licensing for social equity applicants—aim to foster a more diverse and competitive marketplace [113, 114]. The measures lower barriers and may increase the availability and affordability of medical cannabis, particularly in underserved areas. However, further research is needed to evaluate the impact of these policies.

Socioeconomic Status

Stakeholder interviews noted the financial burden that medical cannabis imposes on many patients in Massachusetts. No insurance coverage is available and out-of-pocket costs can reach hundreds of dollars per month, making sustained treatment challenging [123, 124]. A survey of adult users revealed that 34% avoided purchasing legal cannabis entirely due to high prices [119]. Similar affordability concerns have been documented in other state medical programs, including Minnesota, Pennsylvania, and Ohio, where patients reported discontinuing treatment due to financial constraints [125-128]. Findings highlight the need for policies that address cost barriers, to ensure continued access for medical cannabis patients.

For Massachusetts, a vertically integrated medical cannabis market amplifies financial challenges. MTCs must cultivate, process, and retail their own cannabis products, rather than sourcing from independent growers or manufacturers. The structure was designed to maintain strict quality control, to enhance patient safety, and to streamline regulatory oversight. However, the model imposes significant operational costs on businesses, which must invest in cultivation infrastructure, manufacturing facilities, and retail operations rather than specialize in a single part of the supply chain. Such added costs are ultimately passed on to patients, contributing to higher prices for medical cannabis products compared with prices in markets that allow wholesale distribution and competition among independent producers.

Some dispensaries offer voluntary discount programs—targeting veterans, seniors, industry agents, and new patients—but lack standardization across the state, and financial hardship programs vary widely in eligibility criteria and benefits [129]. Similarly, financial hardship programs vary widely in eligibility requirements and discount rates, creating inconsistent support. Initiatives like the Massachusetts Patient Advocacy Alliance (MPAA)'s Cannabis Care Connect and the Frank Friends Initiative have addressed some financial barriers, helping patients through reduced-cost certifications, vouchers, and scholarships [130]. The Frank Friends Initiative provides 50% discounts on products and services for vulnerable populations, such as individuals with HIV/AIDS experiencing financial hardship [131]. Expanding targeted financial assistance programs and ensuring standardized pricing structures across MTCs could improve affordability and prevent patients from shifting to the adult-use market.

Sustaining the Massachusetts Medical Cannabis Market

The Massachusetts medical cannabis program has faced several challenges, yet has experienced a different trajectory than similar programs in Colorado and Oregon, where medical patient registrations declined by 22% and 55%, respectively, following adult-use legalization. In contrast, Massachusetts' medical patient registry grew by 51% from 2019 to 2022. Trends suggest that strict regulatory policies—such as licensing structures, dispensary density tracking, and restrictions on transitioning medical businesses to adult-use—have helped sustain participation in Massachusetts [26].

3.4 Conclusion: Availability, Use, and Access to Medical Cannabis

Massachusetts has made progress in expanding access to medical cannabis through initiatives such as mobile dispensaries, telehealth services, and financial assistance programs. However, the scope of such initiatives and implementation remain limited, and geographic disparities and high out-of-pocket costs remain. Some patients may turn to taxed dispensaries or unregulated markets, potentially affecting affordability and product safety. The state's medical cannabis program has shown resilience compared to other states, but recent data indicate a plateau and gradual decline in patient registrations. This trend aligns with patterns seen in other states following adult-use legalization and suggests that ongoing evaluation of the medical program's accessibility and affordability will be important.

To support the long-term stability of the medical market, policies could focus on maintaining strong medical licensing requirements while ensuring distinctions between medical and adult-use markets. Additionally, financial considerations are still a key factor for many patients. Expanding standardized discount programs, implementing tax exemptions for medical cannabis products, and exploring pathways for insurance coverage could help improve affordability and sustain patient participation.

The following policy considerations outline actionable steps to enhance geographic access, affordability, and overall equity in Massachusetts's medical cannabis program (**Exhibit 16**).

Exhibit 16. Policy Considerations: Enhancing Availability, Use, and Access to Medical Cannabis

Category	Recommendation	Key Action Steps	Objective
Affordability	Standardize discount programs for vulnerable populations.	Implement uniform discounts for veterans, seniors, and low-income patients across MTCs.	Ensure equitable affordability for vulnerable populations.
	Establish tax exemptions for medical cannabis.	Remove or reduce state taxes on medical cannabis purchases.	Align medical cannabis costs with essential medications.
	Advocate for insurance coverage of medical cannabis.	Collaborate with state and federal policymakers to integrate cannabis into health care reimbursement frameworks.	Reduce out-of-pocket expenses for patients.
Geographic Access	Expand medical cannabis delivery infrastructure.	Increase availability of delivery services in rural and underserved areas.	Improve geographic access to medical cannabis.

NOTE: MTCs= Medical Marijuana Treatment Centers.

4. Surveillance and Research in Massachusetts

Robust data collection and analysis are key to understand the impacts of medical cannabis on public health, patient outcomes, and health care systems. In Massachusetts, existing data sources—such as surveys, health care administrative data sets, and the mandatory seed-to-sale tracking system—primarily focus on adult-use cannabis. This focus presents challenges in comprehensively evaluating medical cannabis use, particularly on patient outcomes, therapeutic efficacy, and program effectiveness. This section examines the current state of cannabis surveillance and research in Massachusetts and discusses key gaps in data collection and analysis **(Exhibit 17).** It also explores examples from other states that have successfully integrated medical cannabis into their public health frameworks.

Exhibit 17. Key Insights: Data Gaps and Research Limitations in the Massachusetts Medical Cannabis Program

Domain	Key Insight
Gaps in Medical Cannabis Data	Massachusetts lacks comprehensive tracking of medical cannabis usage, patient outcomes, and safety, limiting evidence-based policymaking.
Existing Data Sources	Current surveillance tools—such as surveys, health care data, and seed-to-sale tracking—prioritize adult-use cannabis, offering limited insights into medical cannabis trends.
Barriers to Research and Funding	Insufficient funding and restricted access to medical cannabis data limit robust, long-term studies on patient outcomes and treatment efficacy, especially by product type, method, and condition.

4.1 Data Sources for Monitoring Cannabis Use and Public Health Outcomes in Massachusetts

Massachusetts relies on three primary data sources to evaluate cannabis use and its public health impacts: survey-based data, health care administrative data, and seed-to-sale tracking data. Each offers unique insights as well as challenges in addressing the evolving cannabis landscape.

Survey Data Sources

Massachusetts uses both national and state-specific surveys to monitor cannabis use patterns, public health impacts, and consumption methods. National surveys like the National Survey on Drug Use and

Health (NSDUH), Behavioral Risk Factor Surveillance System (BRFSS), and National Health and Nutrition Examination Survey (NHANES) provide insights into cannabis use frequency, perceptions, and health behaviors (**Exhibit 18**). State-specific surveys, such as the Massachusetts BRFSS (MA BRFSS) and the Massachusetts Marijuana Baseline Health Study (MBHS), capture trends in problematic use and consumption methods [132-135].

The surveys are effective in tracking general cannabis trends and public perceptions but have notable limitations that hinder a comprehensive evaluation of medical cannabis. Key details—such as product types, cannabinoid profiles (for example, THC:CBD ratios), administration methods, dosages, and treated conditions—are often missing in survey instruments, making it challenging to assess efficacy and safety [136, 137]. Additionally, stigma and underreporting, introduce biases that complicate data analysis [138-140]. Cannabis-related questions are not included consistently in surveys like the Massachusetts BRFSS, reducing data comparability and completeness [133, 141]. Additionally, vulnerable populations—including veterans, pregnant individuals, and institutionalized groups—are frequently excluded, creating gaps in understanding access and outcomes [142].

To address gaps, Massachusetts should enhance its surveillance efforts by incorporating cannabis-specific modules, such as the U.S. Centers for Disease Control and Prevention (CDC)'s Cannabis Module for BRFSS, to capture trends in utilization and health outcomes among medical cannabis patients.

Exhibit 18. Survey Data Sources to Understand Cannabis Use and Health Outcomes

Survey	Description	Strengths	Limitations
National Survey on Drug Use and Health (NSDUH)	Nationally representative data on cannabis use frequency, sources, and perceptions.	Comprehensive data on usage patterns and attitudes.	Restricted access to state-level data; underreporting due to stigma.
Behavioral Risk Factor Surveillance System (BRFSS)	State-based health survey, including optional cannabis-related modules.	State-specific data that captures health-related behaviors.	Optional cannabis questions reduce consistency and comparability.
National Health and Nutrition Examination Survey (NHANES)	Tracks cannabis use as part of broader health assessments in the United States.	Integrates health outcomes with cannabis use patterns.	Limited state-specific data; lacks product and dosage details.
Massachusetts Marijuana Baseline Health Study (MBHS)	One-time state-specific survey on cannabis consumption methods and health effects.	Has a unique focus on methods of use and consumption impacts in Massachusetts.	Single-year data limits longitudinal analysis.

SOURCES: National Survey on Drug Use and Health (NSDUH) Substance Abuse and Mental Health Services Administration (SAMHSA) [132]; Behavioral Risk Factor Surveillance System (BRFSS), U.S. Centers for Disease Control and Prevention (CDC) [133]; National Health Nutrition Examination Survey (NHANES), U.S. Centers for Disease Control and Prevention (CDC) [134]; Marijuana Baseline Health Study, Massachusetts Department of Public Health [135]

Health Care Administrative Data Sources

Health care administrative data are pivotal to evaluate cannabis-related health outcomes, health care utilization trends, and financial impacts, particularly for medical cannabis. Key data sets in Massachusetts—including the All-Payer Claims Database (APCD), Case Mix Data, and the Public Health Data Warehouse (PHDW)—offer insights into the intersection of cannabis use and health care systems [143-145] (**Exhibit 19**).

However, challenges with these data sources limit their utility in advancing medical cannabis policy. The absence of standardized diagnostic codes for cannabis use and the absence of routine cannabis screening in health care settings can lead to inconsistent reporting and unreliable data, hampering efforts to comprehensively understand cannabis-related health effects [142]. Further, access to administrative data sets is restricted by stringent data use agreements and complex cross-agency coordination requirements, limiting opportunities for independent evaluation and informed policy development.

Exhibit 19. Health Care Administrative Data Sources to Understand Cannabis Use and Health Outcomes

Data Set	Description	Strengths	Limitations
MA All-Payer Claims Database (APCD)	Tracks outpatient, inpatient, and pharmacy claims.	Detailed insights into health care spending and utilization trends.	Requires strict data use agreements; limited real-time access.
Case Mix Data	Monitors hospital and emergency department discharges.	Captures cannabis-related diagnoses for insured and uninsured populations.	Inconsistent coding of emerging conditions (for example, cannabinoid hyperemesis syndrome).
Public Health Data Warehouse (PHDW)	Links multiple government data sets for longitudinal studies.	Enables analysis of cannabis use impacts over time.	Complex data integration and cross-agency coordination required.

SOURCES: Massachusetts All-Payer Claims Database (APCD), Center for Health Information and Analysis (CHIA) [145]; Case Mix Data, Center for Health Information and Analysis (CHIA) [144]; Public Health Data Warehouse (PHDW), Massachusetts Department of Public Health (MDPH) [143].

Seed-to-Sale and Point-of-Sale Data Platform

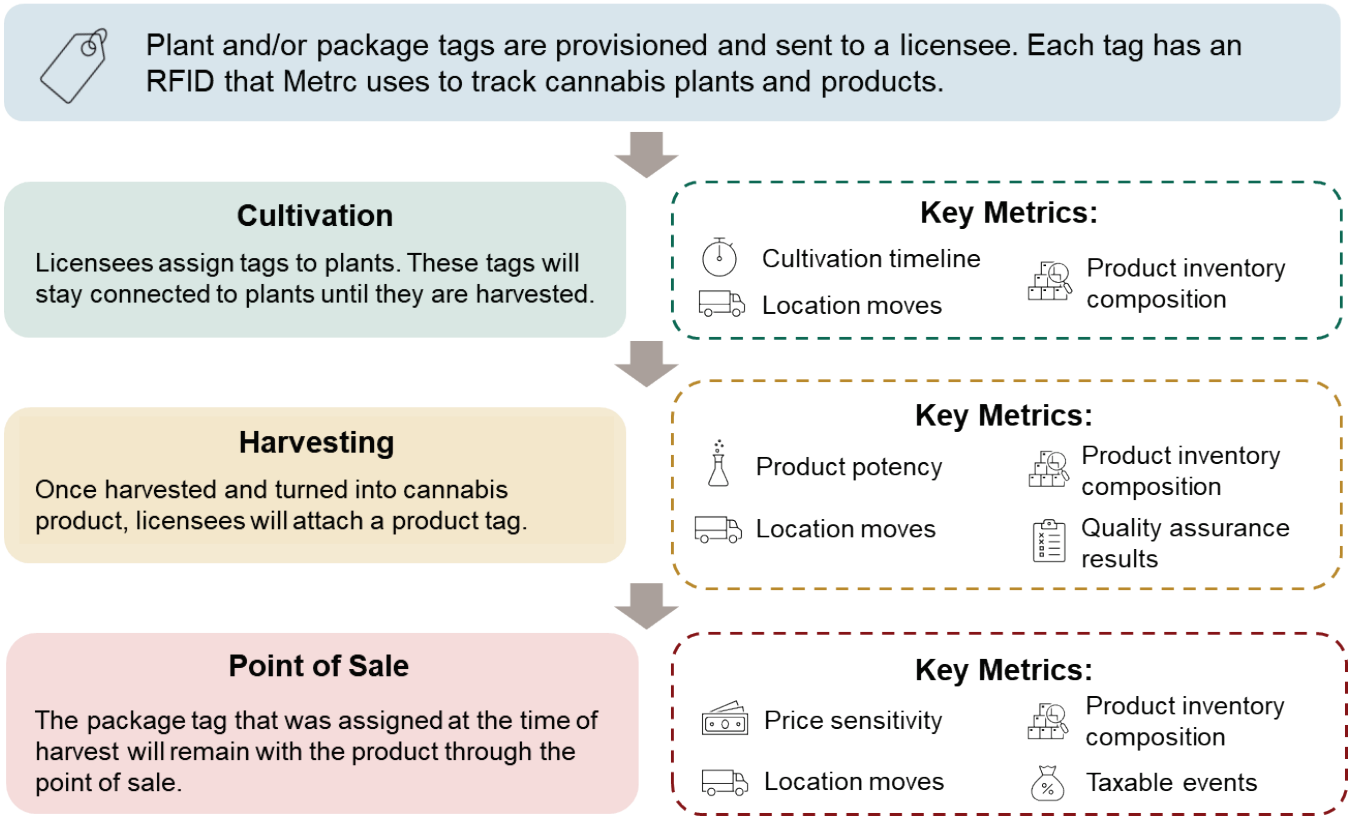
Massachusetts employs Metrc, a seed-to-sale tracking system, to ensure oversight and compliance across the cannabis supply chain. All licensed MTCs and dispensaries are required to use this web-based system, which tracks cannabis plants and products from cultivation to point-of-sale using radio frequency identification technology and serialized tags [114, 146] **(Exhibit 20)**.

The seed-to-sale system ensures product integrity, compliance, tax collection, and public safety while discouraging illicit market activity. Initially developed within the medical software industry to prevent drug diversion, these systems have become critical tools for cannabis market regulation [147]. In Massachusetts, the system tracks key metrics such as product potency, consumption methods (for

example, vaping, edibles), and price sensitivity, providing key data for public health interventions, compliance monitoring, and policy development.

However, the current system primarily focuses on the adult-use market, leaving significant gaps in its ability to evaluate the medical cannabis program. The Massachusetts Open Data Platform, managed by the CCC, offers centralized access to data on licensing, sales, tax revenue, and market trends [25]. While useful, it lacks robust integration of medical cannabis-specific metrics such as patient demographics, treated conditions, and therapeutic outcomes.

Exhibit 20. Massachusetts Seed-To-Sale Tracking Process



SOURCE: Developed by NORC based on the Massachusetts Cannabis Control Commission, Seed-to-sale Tracking

4.2 Massachusetts Research Efforts

Despite the state's progress in integrating medical cannabis into clinical practice, Massachusetts has yet to conduct a comprehensive evaluation of its medical cannabis program. Evidence-based policymaking requires detailed data on patient usage patterns, therapeutic outcomes, and overall patient experiences. Massachusetts has no longitudinal studies dedicated specifically to medical cannabis patients.

Cannabis Control Commission Research Department

The CCC's Research Department manages a research agenda to inform cannabis policy. The agenda spans economic and health impacts, market trends, and public health risks, and involves collaborations with state agencies, academic researchers, and industry stakeholders [148] (**Exhibit 21**).

Exhibit 21. Cannabis Control Commission Research Domains

Source: Massachusetts Cannabis Control Commission, The State of Medical Cannabis, (April 2024) [149]

The CCC collects both primary and secondary data to generate state-level reports, peer-reviewed studies, and national conference presentations. Despite a broad research framework, medical cannabis data remains underrepresented, particularly regarding long-term patient outcomes, product efficacy, and safety monitoring. Unlike adult-use cannabis, where market trends and tax revenue provide clear insights, medical cannabis requires a more patient-focused research approach that examines clinical outcomes, therapeutic effectiveness, and safety monitoring [150]. The recent approval of Massachusetts' first Marijuana Research Facility underscores the state's commitment to advancing cannabis science. The facility is expected to support research efforts by addressing long-standing gaps in patient outcomes, product efficacy, and safety monitoring [151].

Gaps in Medical Cannabis Research

The dual-market system for medical and adult-use cannabis in Massachusetts presents challenges in data collection and patient monitoring, particularly in distinguishing medical patient trends from general consumer behavior. Stakeholder interviews identified barriers to data accessibility, including limited patient tracking beyond initial registration, insufficient research on patient outcomes, and difficulties integrating medical cannabis data into broader health surveillance systems. The gaps make it challenging to assess treatment adherence, symptom management, dosage effectiveness, condition-specific efficacy, adverse events, and interactions with other medications or substances.

To strengthen the state's medical cannabis research infrastructure, stakeholders emphasized the need for expanded data collection and targeted studies. Enhancing the CCC's research efforts by

incorporating detailed patient demographics, treated conditions, and product safety metrics would improve public health insights. Additionally, segmenting medical cannabis users based on product types, administration methods, and medical conditions could provide a more nuanced understanding of patient needs and risks. Another recommendation included requiring MTCs to allocate resources for state-level research, ensuring sustainable studies on product efficacy and broader public health outcomes. Stakeholders also noted the importance of coordination between the CCC and DPH to facilitate data sharing, research oversight, and medical cannabis program evaluation. Establishing a structured feedback mechanism between these agencies could help align medical cannabis research with broader public health priorities and inform future policy discussions.

Lessons from Other States' Data and Research Efforts

New York and Minnesota offer models for integrating medical cannabis data into broader health care monitoring systems to improve patient outcomes and regulatory oversight. New York integrates medical cannabis purchase data with its Prescription Drug Monitoring Program (PDMP), allowing health care providers and pharmacists to track patient treatment histories and monitor cannabis as a therapeutic intervention. While access is restricted, researchers have used this data set to analyze real-world consumption patterns and health outcomes [152-155]. Studies from New York's data set indicate that chronic pain patients using medical cannabis reduced opioid dosages by up to 51%, suggesting potential harm reduction benefits [156]. Longitudinal studies in New York have also tracked THC and CBD dosing trajectories among medical cannabis patients with varied conditions, emphasizing the need for personalized dosing strategies and standardized guidelines to ensure safe and effective treatment [157]. Minnesota's medical cannabis program shows how robust data collection and analysis can influence evidence-based policymaking. The state mandates detailed tracking of patient demographics, qualifying conditions, and product characteristics such as formulation types (capsules, oral solutions, vaporizers) and cannabinoid content. Patients consult with health care professionals and pharmacists at state-licensed dispensaries to customize product selection and dosing. This structured approach has generated a rich data set, enabling analyses of product preferences, dosing patterns, and the impact of age on THC and CBD consumption [158]. Collaborations with universities and licensed manufacturers in Minnesota have yielded peer-reviewed studies on patient adherence, dosing trends, and product efficacy [159-161]. These insights inform policy refinements, dosing guidance, and regulatory adjustments.

Advancing Medical Cannabis Research Through Structured Evaluations

Evaluations conducted in Maryland, Minnesota, New Mexico, Ohio, Pennsylvania, and Rhode Island demonstrate the value of structured assessments in understanding and improving medical cannabis programs [125-128, 162-164]. The evaluations used patient surveys, provider interviews, enrollment data analysis, and market assessments to examine program operations, patient experiences, and regulatory effectiveness. By systematically evaluating access, affordability, provider engagement, and patient outcomes, states have been able to refine policies, enhance patient safety, and strengthen oversight mechanisms. Massachusetts can benefit from adopting similar evaluation strategies to track long-term patient outcomes, assess program accessibility, and ensure that medical cannabis regulations align with

public health priorities. Implementing structured research efforts will support evidence-based policymaking, improve provider and patient education, and enhance the overall effectiveness of the state's medical cannabis program.

Findings from these state evaluations are incorporated throughout this issue brief in sections addressing patient access, cost barriers, provider engagement, and regulatory oversight.

Leveraging Funding and Partnerships for Research Advancement

Interviews with Massachusetts stakeholders highlight the need for expanded research funding to address knowledge gaps in medical cannabis. Several states allocate cannabis tax revenue to public health studies, providing models for Massachusetts to strengthen its research infrastructure.

Funding priorities in other states include dosing protocols, product safety, and the long-term health impacts of medical cannabis use. California and Colorado direct tax revenue toward health and safety research through partnerships with institutions like the University of California/San Diego and the University of Colorado [165, 166]. Michigan and New York reinvest recreational cannabis revenue into public health studies, with research hubs such as the State University of New York (SUNY) examining medical efficacy and broader social impacts. Pennsylvania links dispensaries with universities for real-world data collection, while Utah funds studies on chronic conditions, including PTSD and cancer [167-169]. Minnesota prioritizes patient-reported outcomes, using Department of Health resources to inform regulatory decisions [170].

These approaches show the value of sustained funding, academic collaboration, and research integration within cannabis regulatory frameworks. Examining similar strategies may help Massachusetts refine its research efforts and develop policies that balance patient access with safety and oversight.

4.3 Conclusion: Advancing Research and Surveillance for the Massachusetts Medical Cannabis Program

Massachusetts can enhance its medical cannabis program by developing a more integrated framework for research and surveillance. Expanding data collection, improving public health monitoring, and strengthening the evidence base could support informed policymaking and program sustainability (**Exhibit 22**). Establishing stable funding mechanisms, increasing data accessibility, and examining models from other states may further contribute to a more comprehensive approach. These efforts have the potential to improve patient safety, optimize therapeutic outcomes, and promote equitable access to medical cannabis. The following policy considerations outline potential strategies to support these goals.

Exhibit 22. Policy Considerations: Research and Surveillance

Category	Recommendation	Key Action Steps	Objective
Sustainable Funding for Medical Cannabis Research	Establish a stable and diversified funding model for medical cannabis research.	• Allocate a part of cannabis tax revenue and mandate industry contributions to support longitudinal studies, patient outcomes research, and cannabis efficacy assessments. • Develop a centralized research hub to coordinate multi-institution collaborations and streamline funding distribution. • Ensure sustainable funding to continue cannabis-related modules in national and state health surveillance tools for long-term monitoring and trends analysis.	Ensure long-term investment in medical cannabis research and align efforts with public health priorities.
Enhanced Data Collection and Integration	Strengthen data infrastructure to improve surveillance and oversight of the medical cannabis program.	• Expand patient data collection within the seed-to-sale system and integrate it with the Prescription Drug Monitoring Program (PDMP).	Enable comprehensive tracking of patient demographics, treated conditions, and health outcomes to support informed policy and clinical decision-making.
Improved Transparency and Public Access to Data	Expand public access to anonymized data to enhance regulatory oversight and research accessibility.	• Enhance the CCC's Open Data Platform to include anonymized patient and product safety data. • Develop public dashboards that present aggregated insights on medical cannabis use, safety concerns, and program effectiveness. • Facilitate de-identified data sharing with external researchers for independent studies.	Increase transparency, support evidence-based policymaking, and strengthen public trust in the medical cannabis program.
Advancing Medical Cannabis Research Priorities	Prioritize targeted research on long-term patient outcomes, product safety, and treatment efficacy.	• Commission longitudinal studies to assess the long-term effects of medical cannabis use across different patient populations and conditions. • Segment research efforts by product types, administration methods, and medical conditions to provide a patient-centered approach.	Address critical gaps in medical cannabis research, optimize treatment guidelines, and inform regulatory decisions.
DPH and CCC Collaboration	Enhance collaboration between DPH and the CCC to support medical cannabis oversight.	• Explore joint initiatives between DPH and the CCC to facilitate data sharing, oversight, and medical cannabis program evaluation.	Assess ways to improve coordination between agencies to align medical cannabis considerations with broader public health priorities and to inform policy discussions.

5. Enhancing Public Health Through Education and Training

Education and training are fundamental to the safe and effective use of medical cannabis in Massachusetts. A well-informed health care system ensures that patients receive appropriate guidance, providers are equipped with evidence-based knowledge, and dispensary staff can offer accurate, non-medical support. As medical cannabis use expands, the need for standardized education becomes more pressing to support clinical decision-making, improve patient-provider communication, and ensure responsible product selection.

This section examines key areas and gaps of medical cannabis education, including provider training, patient awareness, and MTC and dispensary staff preparedness **(Exhibit 23).** It also explores best practices from other states with structured educational frameworks and considers strategies to enhance training programs. Strengthening education at all levels can improve patient outcomes, enhance provider confidence, and promote responsible cannabis use across the medical program.

Exhibit 23. Key Insights: Gaps in Medical Cannabis Education, Training, and Awareness

Domain	Key Insight
Provider Knowledge and Training	Continuing medical education (CME) requirements inadequately address cannabis pharmacology, contraindications, and drug interactions, leaving providers hesitant and underprepared to guide patients effectively.
Patient-Provider Relationship and Feedback	Inconsistent follow-up protocols and a lack of standardized tools for patient assessment hinder safe and effective cannabis use monitoring.
MTC and Dispensary Employee Knowledge and Training	Employees often rely on anecdotal guidance rather than evidence-based practices.
Patient Education and Awareness	Patients often prioritize high THC products due to limited education on cannabinoid profiles, administration methods, and therapeutic alignment, highlighting significant gaps in patient-focused guidance.

5.1 Provider Knowledge and Training

Provider Knowledge Gaps and Educational Challenges

With growing public acceptance of medicinal cannabis, health care providers are increasingly fielding patient inquiries about use and access. However, surveys consistently highlight significant knowledge gaps and a strong demand for further education [8-10]. Many physicians, including family practitioners, internists, oncologists, and nurse practitioners, lack a comprehensive understanding of condition-specific cannabis evidence [13], while university-affiliated health system physicians report only moderate factual knowledge [14]. Key barriers to prescribing include limited scientific evidence, uncertainty regarding dosing and administration, and concerns over drug interactions [15, 171]. Without clear, evidence-based guidelines, many providers rely on informal sources—colleagues, patients, or media—for cannabis-related information [11]. However, online sources and social media often provide inconsistent and unreliable guidance, making it difficult for providers to find credible information [16, 17, 19, 20]. New Mexico's medical cannabis program evaluation revealed discrepancies between how patients and clinicians perceive cannabis treatment, emphasizing the need for standardized clinical guidance to ensure consistent and evidence-based provider recommendations [163].

Current Training Requirements

The Massachusetts CCC mandates continuing medical education (CME) credits for medical cannabis providers, covering topics such as cannabis use, side effects, dosage, and cannabinoid effects [172, 173]. However, stakeholders report that the requirements do not address critical areas such as cannabis pharmacology, contraindications, and drug interactions. Unlike traditional medications, most cannabis products lack rigorous clinical testing, standardized dosing protocols, and consistent safety standards. The lack of FDA-approved guidelines and high-quality research adds to provider uncertainty, leading some patients to self-medicate and replace prescription medications without medical oversight, increasing safety risks [174]. Addressing such gaps requires enhanced provider education, clearer clinical guidelines, and continued research to ensure safe and informed medical cannabis use.

Fragmented Guidance in the United States and International Approaches

In the United States, professional development resources on medicinal cannabis have expanded in response to patient demand, but cannabis guidance remains fragmented [7, 112]. Internationally, government agencies, national institutes, and medical academies have developed resources, including position statements and clinical guidelines, yet standardization remains a challenge [1, 175-181]. For example, a National Academies of Sciences, Engineering, and Medicine (NASEM) report supports cannabis for chronic pain management, while the International Association for the Study of Pain does not endorse its use due to insufficient high-quality trials [1, 182]. Clinical guidance on medicinal cannabis varies widely across jurisdictions, often shaped by regulatory frameworks rather than standardized clinical evidence [7]. Most guidelines cover essential components—such as the endocannabinoid system, clinical

pharmacology, condition-specific evidence, therapeutic hierarchy, product-specific information, safety considerations, monitoring, dependency, toxicity, and cessation strategies—but their scope and rigor differ significantly [5]. A major limitation of existing guidelines is the scarcity of high-quality RCTs to substantiate the therapeutic benefits of cannabis. Much of the available evidence relies on observational studies, real-world data, and limited placebo-controlled trials, which often lack direct comparisons to established best practices [107, 112]. The lack of independent, standardized training materials contributes to inconsistencies in provider knowledge and clinical decision-making. As medical cannabis use expands, international collaboration on pharmacovigilance and evidence collection will be crucial to strengthen clinical guidance and inform regulatory frameworks.

Best Practices and Lessons for Massachusetts

Massachusetts can adopt best practices from other jurisdictions that have developed structured, evidence-based guidance. Minnesota emphasizes clear dosing protocols and condition-specific guidelines synthesized from clinical trials, observational studies, and expert consensus [183]. New York and Utah also provide condition-specific recommendations [167, 184].

Internationally, several countries offer promising models. Australia's Therapeutic Goods Administration provides national guidelines synthesizing clinical evidence for conditions such as multiple sclerosis, epilepsy, chronic pain, palliative care, and chemotherapy-induced nausea [175]. The New South Wales Clinical Cannabis Medicines Program supplements Australia's national guidelines with state-specific prescribing recommendations [185]. Similarly, Health Canada's guidance offers a broad clinical framework covering dosing, pharmacology, and adverse effects, supplemented by Drug and Health Technology Agency reviews on palliative care, pain, dementia, and spasticity [176]. The United Kingdom's National Institute for Health and Care Excellence (NICE) guidelines address chronic pain, intractable nausea, spasticity, and severe epilepsy but have been criticized for their conservative approach [179, 186]. Ireland's Department of Health guidance emphasizes informed consent and patient monitoring but is limited to multiple sclerosis-related spasticity, chemotherapy-induced nausea, and refractory epilepsy [177]. The Netherlands' Office of Medicinal Cannabis has developed resources detailing product selection, dosing, administration, and pharmacokinetic properties, with a focus on flower-based products [187]. Canada's "Start Low, Go Slow" dosing strategy emphasizes gradual titration, encouraging patients to begin with a low dose and increase slowly to minimize adverse effects while achieving optimal therapeutic benefits [176].

Massachusetts could build on such models and also on U.S. Preventive Services Task Force recommendations, such as routine substance use screenings, to standardize care, enhance patient safety, and support early identification of cannabis use [188]. Expanding CME requirements to include structured, clinician-led care plans—covering starting dosages, THC limits, treatment durations, and CUD monitoring—would better equip providers to integrate medical cannabis safely into treatment regimens.

5.2 Patient-Provider Relationship and Feedback

A strong patient-provider relationship is key to ensure the safe and effective use of medical cannabis. Open, informed discussions about cannabis use improve patient outcomes and satisfaction, particularly among older adults [189]. When health care providers act as the primary source of cannabis-related information, patients are less likely to hold misconceptions, such as believing cannabis is entirely non-addictive [190]. However, stakeholder interviews in Massachusetts revealed inconsistencies in these interactions, emphasizing the need for standardized tools to assess patient needs, track cannabis use, and align treatments with therapeutic goals.

Massachusetts mandates a "bona fide" relationship, requiring providers to assess a patient's medical history, maintain health records, and monitor treatment outcomes [114]. However, there are no follow-up care protocols. This gap leaves providers without reliable methods to evaluate patient progress, address adverse effects, or adjust dosages appropriately, particularly for patients with comorbidities or those taking multiple medications.

To strengthen provider oversight and ensure continuity of care, each patient should have a clinically guided, accessible care plan for medical cannabis use, based on their medical history and concurrent treatments. The care plan should include recommended starting dosages, THC limits, and defined treatment timeframes. Providers should adjust plans based on patient feedback, with ongoing access to clinicians for reassessment. Additionally, quarterly monitoring for misuse and CUD should be standard practice, improving patient safety and treatment efficacy.

Minnesota's medical cannabis program offers a valuable model, emphasizing pharmacist-led consultations, routine patient check-ins, and adverse event reporting systems [170]. Massachusetts could adopt similar elements—such as structured patient assessments, personalized product recommendations, and ongoing monitoring—to enhance treatment safety and efficacy. Standardized protocols for adverse event reporting and dynamic care plan updates would align medical cannabis oversight with broader health care standards, improving both safety and outcomes.

5.3 MTC and Dispensary Employee Knowledge and Training

Employees play a pivotal role in shaping patients' understanding of cannabis products [191, 192]. Many patients rely on staff for product recommendations and medical advice, frequently bypassing discussions about cannabis use with their primary care providers [174, 193]. In Massachusetts, patients can obtain cannabis through both MTCs and adult-use dispensaries, making staff at these facilities a primary point of contact. This dual-access system for medical and adult-use cannabis further enables patients to go without health care provider input entirely.

This dynamic positions MTC and dispensary staff as influential figures in product selection and in informing patients about the therapeutic potential of cannabis. To safeguard patient safety and ensure informed decision-making, it is crucial that all staff—regardless of the facility type—are adequately trained to provide accurate, evidence-based information while adhering to their non-medical advisory roles. Comprehensive

training and oversight should apply to both MTC and dispensary staff to deliver consistent and reliable evidence-based guidance across all points of access for medical cannabis patients.

Current Challenges in MTC and Dispensary Staff Knowledge and Training

The CCC mandates staff training on product knowledge, safety protocols, and state regulations. Stakeholders highlighted several concerns during interviews, including:

- **Reliance on Anecdotal Guidance.** Staff often base recommendations on personal experience or anecdotal evidence rather than standardized, evidence-based information, resulting in inconsistent advice.
- **Incentive-Driven Recommendations.** Some staff prioritize promoting high-margin or popular products over those that best align with patients' therapeutic needs.

To safeguard patient health, health care providers—not MTC or dispensary staff—should directly counsel patients on cannabis use.

Stakeholders emphasized the need for state-sponsored training programs to equip MTC and dispensary staff with clear guidance on when advice may cross a threshold into providing clinical guidance.

To meet the unique needs of medical cannabis patients, Massachusetts should establish oversight for medical cannabis separate from oversight of adult-use recreational cannabis. This distinction would allow MTC and dispensary staff training programs to focus specifically on the requirements of medical patients, emphasizing evidence-based product knowledge and delineating clear boundaries between medical and adult-use recreational cannabis guidance. Regular audits and updates to the training programs would ensure alignment with the latest research and updated standards in medical cannabis care.

Reinforcing the role of MTC and dispensary staff as non-medical advisers is also critical to patient safety. Clear guidelines should be implemented to define their responsibilities, ensuring patients are encouraged to seek medical advice from licensed health care providers for therapeutic cannabis use. This approach would enhance the consistency and accuracy of information provided by staff while safeguarding the health and well-being of medical cannabis patients across the state.

5.4 Patient Education and Awareness

Despite the growing acceptance of medical cannabis, many patients lack the guidance needed to make informed decisions, often relying on MTC and dispensary employees for recommendations, the internet, or social media [190, 194]. This reliance could result in the selection of high THC products, which may not align with specific therapeutic needs, highlighting critical gaps in patient education [195].

Stakeholder interviews underscored the urgent need for comprehensive, patient-centered education to support responsible use, to minimize risks, and to improve treatment effectiveness. Educational efforts

should focus on condition-specific guidance, proper dosing strategies, and the therapeutic roles of various cannabinoids and product formulations.

The CCC's *More About Marijuana* campaign provides general information on cannabis use, potency, and safety, but it does not adequately address the unique needs of medical cannabis patients [196]. Evaluations from other states reinforce findings about gaps. Evaluations of Maryland, New Mexico, and Pennsylvania programs found that dispensaries and the internet were the most widely relied-upon sources of medical cannabis information among program participants, often leading to inconsistent or incomplete guidance [127, 128, 162, 163]. Minnesota's evaluation found that 52% of patients who used the state medical cannabis website and call center found these resources helpful, suggesting that a well-structured, centralized educational platform can improve patient decision-making [170].

Additionally, medical cannabis program evaluations conducted in Maryland, Minnesota, New Mexico, Ohio, Pennsylvania, and Rhode Island indicated that patients widely reported medical cannabis as effective for chronic pain, PTSD, and anxiety, reinforcing the need for condition-specific efficacy research and tailored educational resources to ensure patients make informed treatment choices [126-128, 162, 163, 170].

Strengthening Patient Education and Public Awareness

Educational efforts should provide condition-specific guidance, evidence-based dosing strategies, and a clear understanding of cannabinoids and product formulations. Expanding public education efforts to include tailored resources, guided by recommendations from the NASEM, could close this gap [142]. Efforts should focus on:

- Promoting informed product selection aligned with therapeutic goals
- Communicating risks associated with high THC products, drug interactions, and contraindications
- Providing clear guidance on administration methods and their effects

Massachusetts should develop a centralized educational resource offering evidence-based information on safe product selection, cannabinoid profiles, and administration methods. Building on the CCC's *More About Marijuana* campaign, this resource would empower patients, providers, and MTC and dispensary staff to make informed, evidence-based decisions tailored to individual therapeutic needs.

5.5 Conclusion: Enhancing Public Health Through Education and Training

A comprehensive, evidence-based education and training framework is key to continued success of the Massachusetts medical cannabis program. Strengthening provider education, patient guidance, and MTC and dispensary staff training can enhance patient safety, improve treatment outcomes, and ensure more informed decision-making.

Several policy considerations can enable Massachusetts to reach its goals for the medical cannabis program (**Exhibit 24**). Developing standardized clinical tools and structured follow-up protocols may improve patient-provider engagement and monitoring. Clarifying the advisory roles of MTC and dispensary staff will further support patients in navigating medical cannabis use responsibly. Expanding public education efforts will facilitate responsible product selection and safe cannabis use. Aligning strategies with emerging best practices and regulatory trends may enhance the state's approach, providing a more cohesive and adaptive framework for medical cannabis education.

Exhibit 24. Policy Considerations: Enhancing Public Health Through Education and Training

Category	Recommendation	Key Actions	Objective
Provider Knowledge and Training	Expand provider education on medical cannabis use and best practices.	• Develop guidelines on cannabis pharmacology, contraindications, dosing. • Integrate cannabis-focused training into continuing medical education (CME) programs.	Equip providers with evidence-based tools to guide safe and effective use.
Patient-Provider Interaction	Standardize patient-provider communication and follow-up care.	• Implement structured follow-up protocols for treatment monitoring and dose adjustments. • Incorporate routine substance use screenings and care plans into medical cannabis evaluations. • Develop standardized tools for care plans and patient assessments to ensure consistent and effective monitoring. Include clinician-led care plans with starting dosages, THC maximums, and treatment durations.	Improve patient safety and outcomes through consistent provider oversight and patient monitoring.
MTC and Dispensary Staff Training and Oversight	Strengthen staff training and clarify their role as non-medical advisers.	• Require evidence-based training focused on medical cannabis applications, safety, and patient needs. • Establish boundaries for staff roles, reinforcing non-medical advisory functions.	Ensure staff provide accurate, non-medical guidance while prioritizing patient safety.
Public and Patient Education	Enhance public education efforts and patient-focused resources.	• Expand the *More About Marijuana* campaign to include medical cannabis-specific guidance. • Develop centralized resources on cannabinoid profiles, safe use, and recognizing adverse events. • Promote informed product selection, particularly about high THC risks.	Improve patient decision-making and public awareness through accessible, evidence-based education.
Public Education and Awareness	Expand the CCC's *More About Marijuana* campaign, promoting integrated public health campaigns.	• Resources specific to medical cannabis care plans and therapeutic outcomes. • Tailor messaging to medical patients' unique needs, focusing on safe use and diverse product options. • Highlight risks of high THC products and the informed product selection. • Partner with providers, staff, academic institutions, and public health organizations to share best practices and findings.	Improve public awareness and engagement by integrating medical cannabis education into campaigns that address patient needs, safety, and therapeutic outcomes.

6. Product Quality and Testing

Ensuring the quality and safety of medical cannabis is key to protecting patient health and to maintaining confidence in the program. Patients require consistent cannabinoid formulations, accurate potency labeling, and protection from contaminants such as pesticides, heavy metals, and microbial impurities. Massachusetts has established comprehensive testing protocols, but the standards apply equally to both medical and adult-use cannabis, raising concerns about whether they are sufficient to address the unique needs of medical patients.

This section reviews Massachusetts' cannabis testing framework, focusing on product safety, consistency, and labeling accuracy **(Exhibit 25).** It examines factors such as cannabinoid variability and contamination risks, their implications for medical patients, and best practices from other jurisdictions.

Exhibit 25. Key Insights: Strengthening Product Quality and Safety Standards for Medical Cannabis

Domain	Key Insight
Current Standards	Medical and adult-use cannabis are subject to the same testing protocols, which may not address the unique needs of medical patients.
Cannabinoid Variability	Inconsistent THC and CBD concentrations compromise dosing accuracy and therapeutic efficacy for chronic conditions.
Need for Stricter Standards	Vulnerable medical patients require enhanced testing protocols to address risks from contaminants like mold, pesticides, and heavy metals.

6.1 Current Testing Framework in Massachusetts

In Massachusetts, the CCC oversees product safety and quality through testing protocols enforced by an Investigations and Enforcement Department. The Department issues bulletins, provides technical guidance, and works alongside research and data teams to monitor safety using Metrc, the seed-to-sale tracking system [114]. Testing requirements include screening for contaminants—such as pesticides, heavy metals, residual solvents, and microbial impurities—as well as potency testing to ensure accurate cannabinoid labeling [114]. However, applying the same testing standards to both medical and adult-use cannabis overlooks the unique safety and quality needs of medical cannabis patients, who often require more rigorous protocols to meet their therapeutic needs [197].

The Need for Enhanced Standards for Medical Patients

Medical cannabis patients—often managing chronic conditions or immunocompromised states—are particularly vulnerable to contaminants such as mold, pesticides, and heavy metals, which can cause severe respiratory and systemic complications [197, 198]. Accurate potency testing is fundamental to

ensure safety and therapeutic efficacy. Variability in cannabinoid concentrations, such as THC and CBD levels, can significantly affect treatment outcomes. Batch inconsistencies in cannabinoid levels may lead to ineffective dosing or adverse effects, placing patients at risk [199]. Stakeholder interviews emphasized that medical cannabis patients differ fundamentally from recreational users in that they rely on cannabis as part of their treatment regimens. This distinction requires higher standards for product purity, consistency, and safety. Insights from other state medical cannabis programs, including evaluations from Pennsylvania and Maryland, highlight concerns with inconsistent product quality and availability and underscore the importance of strengthened regulatory oversight and supply chain stability to protect patient health [127, 128, 162].

Learning from Other States

Several states and international jurisdictions have implemented strict medical cannabis standards, offering valuable models for Massachusetts. New York's medical cannabis program mandates rigorous potency testing and comprehensive screening for contaminants, ensuring patients receive safer and more effective products for managing health condition [200]. Canada's federally regulated cannabis program sets a gold standard with its batch-specific testing requirements, independent third-party verification, and standardized labeling of cannabinoid profiles, demonstrating how strong regulations can enhance product safety and transparency [197].

Expanding Oversight and Transparency

To ensure consistent implementation of enhanced testing standards, Massachusetts should strengthen oversight of cannabis testing laboratories. This includes conducting regular audits to assess compliance with standardized methodologies and mandating third-party verification of test results to enhance accountability [197]. Additionally, public disclosure of contaminant levels and potency data would empower patients and providers with transparent, actionable information. Implementing such measures would not only build trust in the state's regulatory framework but also ensure that medical cannabis products meet the highest safety and quality standards and support the health and well-being of patients across the Commonwealth.

6.2 Adopting U.S. Pharmacopeia Standards

The NASEM has highlighted the U.S. Pharmacopeia's (USP) advancements in cannabis testing protocols [142]. The USP's rigorous standards for purity, contaminant thresholds, and cannabinoid consistency offer a valuable framework for improving Massachusetts's medical cannabis regulations [201]. Key USP initiatives include:

- **Validated Testing Methods**. Scientifically established procedures to detect contaminants across multiple cannabinoids, including delta-8-THC.

- **Monographs for Cannabis Products**. Comprehensive standards to assess cannabinoid and terpene profiles, contamination, and product integrity for both inflorescence (flower) and extracts used in edibles or capsules.

By integrating USP guidelines, Massachusetts can enhance therapeutic reliability, bolster patient and consumer confidence, and reinforce public health protections to ensure that medical cannabis products meet rigorous safety and quality standards.

6.3 Transparency in Testing and Labeling

Massachusetts enforces rigorous cannabis packaging and labeling standards to protect consumers and to promote product transparency. However, the unique needs of medical cannabis patients call for refinements to ensure safety, informed decision-making, and therapeutic efficacy.

Current Labeling Standards

Massachusetts requires that all cannabis products display a universal symbol with "Contains THC" text and a marijuana leaf icon. Packaging must avoid appealing visuals like cartoons, though dispensaries can include their logos. Labels must provide patient and dispensary information, product details, and FDA disclaimers. Products must be sold in tamper-proof, child-resistant containers, and edibles must not resemble popular food items like candy, to prevent accidental ingestion. Additionally, individual edible servings are capped at 5.5 mg THC to promote controlled dosing and to mitigate risks for new or vulnerable users [114].

Challenges with Label Accuracy

Across the United States, gaps in labeling accuracy for medical cannabis products highlight the need for improved testing and regulatory oversight. Research has shown that only 17% of edible cannabis products were accurately labeled for THC content, while 60% gave were overlabeled and 23% were underlabeled [23]. Such inaccuracies pose serious risks to patients, including ineffective treatment from underdosed products and adverse effects from overdosed products. Additionally, most products fail to list CBD content accurately, with only a small proportion achieving recommended therapeutic THC to CBD ratios, which can compromise the efficacy of medical cannabis treatments [202]. Discrepancies are particularly concerning for patients managing chronic conditions or relying on precise dosing for therapeutic benefit. Such findings underscore the urgent need for robust testing protocols and standardized labeling to ensure the safety, reliability, and efficacy of medical cannabis products.

Strengthening Labeling Requirements

To meet the specific needs of medical cannabis patients and enhance product transparency, Massachusetts should adopt the following improvements to labeling practices:

- **Comprehensive Cannabinoid Profiles.** Labels should include detailed cannabinoid ratios, such as THC and CBD, ensuring patients and providers can make informed decisions based on therapeutic needs. This is particularly important given the risks associated with high THC:CBD imbalances.
- **Batch-Specific Testing Information**. Incorporating Certificates of Analysis (COAs) ensures verifiable product safety, consistency, and accuracy, addressing issues of variability in cannabinoid content.
- **Accessibility Features**. Larger font sizes and user-friendly symbols can accommodate older adults and visually impaired patients, promoting equitable access to critical information.
- **Digital Enhancements.** QR codes linking to detailed product data, including third-party lab results and batch-specific cannabinoid content, can provide more resources for patients and providers, improving trust and transparency.

6.4 Conclusion: Advancing Product Standards for Medical Cannabis

Ensuring enhanced product quality and safety standards is a critical focus for the Massachusetts medical cannabis program. Current testing protocols apply equally to medical and adult-use cannabis. They may not address the specific needs of medical cannabis patients sufficiently, particularly those managing chronic conditions or with compromised immune systems. Insights from other jurisdictions show the feasibility of tailored testing standards and robust regulatory frameworks. Approaches such as enhanced oversight of cannabis testing laboratories, adherence to rigorous safety protocols, and transparency through labeling and digital tools could improve trust in medical cannabis programs. Additionally, adopting frameworks like those proposed by the USP can give structured guidance to improve product safety and consistency. Several policy considerations follow from the evidence presented in this section (**Exhibit 26**).

Exhibit 26. Policy Considerations: Product Quality and Testing

Category	Recommendation	Key Action Steps	Objective
Testing and Lab Oversight	Strengthen medical cannabis testing standards and lab accountability.	• Establish stricter contaminant thresholds for mold, heavy metals, pesticides, and residual solvents tailored to medical-grade cannabis. • Standardize testing methodologies and enforce third-party verification of results. • Conduct frequent, unannounced audits of testing labs to ensure compliance.	Improve product safety, ensure consistent potency, and enhance lab reliability.
Regulatory Standards	Adopt standardized cannabis testing frameworks.	• Integrate U.S. Pharmacopeia (USP) testing methods for contaminants and synthetic compounds. • Require consistent cannabinoid and terpene profiling to improve product reliability.	Ensure uniform testing protocols and enhance product consistency for medical cannabis patients.
Transparency and Labeling	Improve disclosure of testing results and product contents.	• Mandate clear labeling of contaminant levels, cannabinoid content, and testing methodologies. • Require QR codes on packaging to provide access to Certificates of Analysis and lab verification.	Increase consumer trust, support informed decision-making, and ensure regulatory compliance.
Monitoring and Reporting	Strengthen adverse event reporting and response mechanisms.	• Establish a centralized database for tracking adverse events linked to specific products. • Require dispensaries to regularly report adverse events to regulators.	Enhance patient safety by improving monitoring, early detection, and response to product-related issues.

7. Potential Shifts at the Federal Level

The DEA is considering a proposal to reclassify cannabis from Schedule I to Schedule III under the Controlled Substances Act. The proposed rescheduling follows a recommendation from HHS in 2023, based on updated scientific evidence regarding cannabis's medical potential and lower abuse risk compared with other Schedule I substances [28].

If enacted, this policy shift would be one of the most significant changes in federal cannabis regulation in decades. Schedule III substances are recognized for having accepted medical uses and a lower

potential for dependence and abuse. They include medications such as ketamine and anabolic steroids, which are subject to fewer regulatory hurdles for research and clinical application.

Key implications of this rescheduling include:

- **Improved Research Opportunities.** Rescheduling would reduce regulatory barriers for researchers, streamline the approval process, and expand access to research-grade cannabis. This could lead to more robust clinical trials, standardized dosing protocols, and evidence-based therapeutic guidelines.
- **Enhanced Clinical Integration.** With a lower classification, physicians might gain greater clarity and confidence in recommending cannabis for therapeutic purposes, potentially aligning medical cannabis with traditional pharmaceutical oversight.
- **Alignment of State and Federal Policies.** Rescheduling could bridge the long-standing disconnect between federal and state regulations, facilitating greater collaboration, clearer enforcement priorities, and a more cohesive national framework.

However, there are significant uncertainties. The Cannabis Regulators Association (CANNRA) has emphasized the need for additional federal guidance to clarify how rescheduling will affect enforcement priorities, state-level regulatory authority, interstate commerce, and banking access [203]. Specific areas requiring clarity include:

- **Federal Enforcement Priorities,** such as clear guidelines on how rescheduling will affect federal enforcement actions on state-regulated medical cannabis markets.
- **Interstate Coordination,** such as allowances for states to share cannabis products for research, quality testing, and regulatory oversight.
- **Research Protocols,** such as clarification on whether researchers can use state-regulated cannabis products in clinical studies.
- **Financial Systems,** such as guidance on how rescheduling will affect cannabis banking, financial services, and the application of federal tax provisions like Section 280E.

Such policy shifts carry significant implications for Massachusetts, where federal restrictions have constrained the integration of medical cannabis into mainstream health care systems. The path toward rescheduling represents progress, but success will depend on clear federal guidance, robust state collaboration, and a commitment to address long-standing regulatory gaps.

Massachusetts continues to lead in medical innovation and equitable health care access. Understanding and preparing for potential federal changes will be key to ensuring that the state's medical cannabis program can adapt effectively and continue to serve patients safely and equitably.

8. Conclusion

Massachusetts's Medical Use of Marijuana Program has changed significantly over the past decade, reflecting the state's commitment to create a regulated framework that balances public health, safety, and patient access. Despite advancements, challenges persist in areas such as research, product quality, public health education, health care integration, and equitable access. The challenges mirror broader systemic barriers, including federal restrictions, fragmented oversight, and the absence of standardized clinical guidelines, Such issues extend beyond Massachusetts and affect medical cannabis programs nationwide.

Despite growing research on cannabinoid pharmacology and therapeutic applications, federal barriers and limited clinical trials hinder the development of clear, evidence-based prescribing guidelines. Many health care providers lack the necessary scientific guidance to offer informed recommendations, leaving patients to seek information from dispensaries, online sources, or social networks—often resulting in inconsistent and unreliable guidance [7, 18-20]. Additionally, the market has seen a surge in high THC products, raising concerns about appropriate dosing, potential adverse effects, and overall patient safety [21, 22]. Inconsistent labeling across cannabis products further complicates patient decision-making, making it difficult to accurately assess potency, cannabinoid content, and therapeutic suitability [23]. Addressing these gaps requires a coordinated effort to strengthen research infrastructure, enhance provider education, and improve product standards, to ensure that patients receive the care, oversight, and therapeutic support they need to manage their conditions safely and effectively.

The following key focus areas outline strategies that may help advance Massachusetts's medical cannabis framework and enhance program effectiveness:

- **Equity in Access and Affordability.** Address geographic disparities, reduce financial barriers, and implement standardized financial assistance programs to ensure that all patients—regardless of location or socioeconomic status—have equitable access to medical cannabis.
- **Strengthening Data and Surveillance Systems.** Enhance medical cannabis surveillance efforts and integrate cannabis-related data into health care monitoring tools to give actionable insights into patient outcomes, product safety, and therapeutic efficacy.
- **Tailored Medical Cannabis Research.** Invest in research specifically focused on medical cannabis, including studies on patient outcomes, dosing protocols, and efficacy across various conditions. Foster partnerships with academic institutions and use real-world data to inform evidence-based policymaking and program advancements.
- **Transparent Communication and Education.** Create centralized educational resources and improve patient-provider communication to promote informed decision-making and safer cannabis use.
- **Enhancing Provider and MTC Knowledge and Training.** Strengthen clinical education, and provide guidelines to MTC staff on cannabis pharmacology, dosing, and contraindications to support patients with evidence-based guidelines.

- **Improving Product Standards.** Establish more rigorous testing protocols tailored to medical cannabis products. Guided by existing frameworks, these standards will ensure product consistency, safety, and therapeutic reliability.

A Path Forward

Massachusetts is well-positioned to leverage its existing medical cannabis framework by fostering innovation, collaboration, and accountability. Continued investment in research, a focus on health equity, and enhanced education and provider training could further strengthen the program's ability to meet patient needs while ensuring public health protections.

The policy considerations in this brief suggest pathways to advance the state's medical cannabis policies. Addressing critical areas such as data and surveillance, product quality, affordability, health care integration, and education may contribute to a more comprehensive and balanced approach to program development.

The Massachusetts experience can also serve as an important model for other states navigating the complexities of medical cannabis regulation. By sustaining a commitment to evidence-based policymaking and ongoing evaluation, the state can enhance its medical cannabis program in a way that supports patients, informs clinical practice, and enhances regulatory clarity. This issue brief offers an assessment of current progress and key areas for refinement, recognizing the role of diverse stakeholders—including policymakers, health care providers, researchers, industry leaders, and patients—in shaping the future of medical cannabis in the Commonwealth.

Attachment 1: Glossary of Terms

Term	Definition
Adverse Event Reporting	A system to document and analyze negative health effects or reactions associated with cannabis use, enabling regulatory oversight and patient safety improvements.
Bona Fide Provider-Patient Relationship	A legally mandated relationship where a health care provider thoroughly assesses a patient's medical history and monitors their treatment outcomes with cannabis.
Cannabidiol (CBD)	A non-psychoactive cannabinoid in cannabis, known for its potential therapeutic benefits, including anti-inflammatory and anti-anxiety effects.
Cannabinoids	Chemical compounds found in cannabis plants, such as tetrahydrocannabinol (THC) (psychoactive) and cannabidiol (CBD) (non-psychoactive) that interact with the body's endocannabinoid system.
Cannabis Control Commission (CCC)	The regulatory body in Massachusetts responsible for overseeing both medical and adult-use cannabis markets, to ensure safety, equity, and compliance.
Cannabis Use Disorder (CUD)	A medical condition characterized by problematic cannabis use, dependency, or withdrawal symptoms, often requiring clinical intervention.
Dispensary	A retail establishment licensed to sell cannabis products for adult-use (recreational) purposes, catering to individuals aged 21 and older.
Dronabinol (Marinol, Syndros)	Cannabis product used to treat nausea and vomiting caused by chemotherapy, for people whose nausea and vomiting have not improved with usual anti-nausea medicine, as well as loss of appetite in people with AIDS who have lost weight.
Epidiolex	Cannabis product used to treat seizures associated with Lennox-Gastaut syndrome, Dravet syndrome, or tuberous sclerosis complex.
Medical Marijuana Treatment Center (MTC)	A state-licensed facility authorized to cultivate, process, and sell cannabis products specifically for medical use by registered patients.
Nabilone (Cesamet)	Cannabis product that treats nausea and vomiting caused by cancer treatment.
Nabiximols (Sativex)	Cannabis product used to treat multiple sclerosis-related spasticity when a person has shown an inadequate response to other treatments.
Prescription Drug Monitoring Program (PDMP)	A system used to track prescriptions and controlled substances used by patients.

Term	Definition
Public Health Data Warehouse (PHDW)	A centralized database that links government data sets to enable longitudinal studies and comprehensive public health analysis.
Schedule I Substance	A Controlled Substances Act classification that indicates a substance with high potential for abuse and no accepted medical use (for example, cannabis, heroin, LSD).
Schedule III Substance	A Controlled Substances Act classification that indicates a substance with moderate to low potential for physical and psychological dependence, less abuse potential than Schedule I or II substances, and accepted medical uses in the United States (for example, ketamine, anabolic steroids, Tylenol with Codeine).
Seed-to-Sale Tracking System	A state-mandated inventory tracking system used to monitor cannabis products from cultivation to final sale, ensuring compliance and preventing diversion.
Tetrahydrocannabinol (THC)	The primary psychoactive cannabinoid in cannabis, responsible for the “high” effect and commonly measured for potency.
U.S. Pharmacopeia (USP) Standards	Scientifically validated guidelines to test cannabis products for contaminants, potency, and quality assurance.

Attachment 2: Pharmacokinetics—A Critical Component of Cannabis Policy

Cannabis pharmacokinetics—the absorption, distribution, metabolism, and excretion of cannabinoids—depend on the method of administration. Pharmacokinetic differences directly affect therapeutic outcomes and safety risks, underscoring the importance of understanding how varied consumption methods influence patient experiences.

Method	Onset	Duration	Key Characteristics
Smoking	Rapid (minutes)	Short (1–3 hours)	Common method offering immediate symptom relief; involves inhaling dried flowers.
Vaporizing	Rapid (minutes)	Short (1–3 hours)	Cleaner alternative to smoking; concerns about unregulated devices and additives, especially post-2019 EVALI crisis.
Edibles	Delayed (30–90 minutes)	Long (4–8 hours)	Popular for long-lasting effects; risk of overconsumption due to delayed onset, especially for inexperienced users.
Concentrates	Rapid (minutes)	Varies (intense effects)	High-potency extracts, often consumed via dabbing; requires regulation to manage risks of high THC concentrations.
Transdermal Applications	Gradual	Sustained	Delivers cannabinoids through the skin, bypassing liver metabolism; offers consistent dosing with minimal psychoactive effects.

NOTES: EVALI=e-cigarette, or vaping product, use-associated lung injury; THC= tetrahydrocannabinol.
Sources: Grotenhermen et al., (2003) [104]; Huestis et al., (1992) [105] ; Barrus et al., (2016) [106]

References

1. National Academies of Sciences, Engineering, and Medicine. (2017). *The health effects of cannabis and cannabinoids: The current state of evidence and recommendations for research.* The National Academies Press.
2. National Conference of State Legislatures. (2025). *State medical cannabis laws.* Retrieved from https://www.ncsl.org/health/state-medical-cannabis-laws
3. Whiting, P. F., et al. (2015). Cannabinoids for medical use: A systematic review and meta-analysis. *JAMA, 313*(24), 2456-2473.
4. Solmi, M., et al. (2023). Balancing risks and benefits of cannabis use: Umbrella review of meta-analyses of randomized controlled trials and observational studies. *BMJ, 382*, e072348.
5. United Nations Office on Drugs and Crime. (2023). *Herbal cannabis for medical use: A spectrum of regulatory approaches.* Vienna, Austria.
6. Cooper, Z. D., et al. (2021). Challenges for clinical cannabis and cannabinoid research in the United States. *J Natl Cancer Inst Monogr, 2021*(58), 114-122.
7. Graham, M., et al. (2023). Medicinal cannabis guidance and resources for health professionals to inform clinical decision-making. *Clinical Therapeutics, 45*(6), 527-534.
8. McLennan, A., et al. (2020). Health care provider preferences for, and barriers to, cannabis use in cancer care. *Current Oncology, 27*(2), e199-e205.
9. Kaplan, L., et al. (2020). Knowledge, practices, and attitudes of Washington State health care professionals regarding medical cannabis. *Cannabis and Cannabinoid Research, 5*(2), 172-182.
10. Braun, I. M., et al. (2018). Medical oncologists' beliefs, practices, and knowledge regarding marijuana used therapeutically: A nationally representative survey study. *Journal of Clinical Oncology, 36*(19), 1957-1962.
11. Carlini, B. H., Garrett, S. B., & Carter, G. T. (2017). Medicinal cannabis: A survey among health care providers in Washington State. *American Journal of Hospice and Palliative Care, 34*(1), 85-91.
12. Philpot, L. M., Ebbert, J. O., & Hurt, R. T. (2019). A survey of the attitudes, beliefs, and knowledge about medical cannabis among primary care providers. *BMC Family Practice, 20*(1), 17.
13. Schauer, G. L., Njai, R., & Grant, A. M. (2022). Clinician beliefs and practices related to cannabis. *Cannabis and Cannabinoid Research, 7*(4), 508-515.
14. Kruger, D. J., et al. (2022). Assessing health care providers' knowledge of medical cannabis. *Cannabis and Cannabinoid Research, 7*(4), 501-507.
15. Hachem, Y., et al. (2022). Healthcare practitioner perceptions on barriers impacting cannabis prescribing practices. *BMC Complementary Medicine and Therapies, 22*(1), 237.
16. Ng, J. Y., Dzisiak, D. A., & Saini, J. B. (2021). Cannabis for pain: A cross-sectional survey of the patient information quality on the Internet. *Journal of Cannabis Research, 3*(1), 36.
17. Shi, S., et al. (2019). False news of a cannabis cancer cure. *Cureus, 11*(1), e3918.

18. Tran, T., & Kavuluru, R. (2020). Social media surveillance for perceived therapeutic effects of cannabidiol (CBD) products. *International Journal of Drug Policy, 77*, 102688.
19. Jia, J. S., et al. (2021). Marijuana and glaucoma: A social media content analysis. *Ophthalmology Glaucoma, 4*(4), 400-404.
20. Macedo, A. C., et al. (2022). Online information on medical cannabis is not always aligned with scientific evidence and may raise unrealistic expectations. *Journal of Cannabis Research, 4*(1), 37.
21. Chandra, S., et al. (2019). New trends in cannabis potency in USA and Europe during the last decade (2008-2017). *European Archives of Psychiatry and Clinical Neuroscience, 269*(1), 5-15.
22. Hall, W., et al. (2019). Public health implications of legalizing the production and sale of cannabis for medicinal and recreational use. *The Lancet, 394*(10208), 1580-1590.
23. Vandrey, R., et al. (2015). Cannabinoid dose and label accuracy in edible medical cannabis products. *JAMA, 313*(24), 2491-2493.
24. Massachusetts Cannabis Control Commission. (2024). *935 CMR 501.000: Medical use of marijuana.* Retrieved from https://www.mass.gov/files/documents/2019/02/09/Medical-Regs-501-PDF-Converted_0.pdf
25. Massachusetts Cannabis Control Commission. (2024). *Massachusetts Cannabis Control Commission Open Data Catalog.* Retrieved from https://masscannabiscontrol.com/open-data/data-catalog/
26. Colby, A. M., et al. (2023). Medical cannabis program sustainability in the era of recreational cannabis. *Clinical Therapeutics, 45*(6), 578-588.
27. Congressional Research Service. (2022). *The Schedule I status of marijuana (IN11204).* Washington, DC.
28. U.S. Department of Health and Human Services. (2023). *Basis for the recommendation to reschedule marijuana into Schedule III of the Controlled Substances Act.* Washington, DC.
29. Compton, W. M., et al. (2017). Use of marijuana for medical purposes among adults in the United States. *JAMA, 317*(2), 209-211.
30. Marijuana Policy Project. (2024). *Medical marijuana patient numbers.* Retrieved from https://www.mpp.org/issues/medical-marijuana/state-by-state-medical-marijuana-laws/medical-marijuana-patient-numbers/
31. U.S. Drug Enforcement Administration. (2025). *Drug scheduling.* Retrieved from https://www.dea.gov/drug-information/drug-scheduling
32. National Institute on Drug Abuse. (2016). *NIDA's role in providing marijuana for research.* Retrieved from https://www.drugabuse.gov/drugs-abuse/marijuana/nidas-role-in-providing-marijuana-research
33. Aizpurua-Olaizola, O., et al. (2016). Evolution of the cannabinoid and terpene content during the growth of *Cannabis sativa* plants from different chemotypes. *Journal of Natural Products, 79*(2), 324-331.
34. Pertwee, R. G. (2006). Cannabinoid pharmacology: The first 66 years. *British Journal of Pharmacology, 147*(Suppl 1), S163-S171.

35. Pertwee, R. G. (1997). Pharmacology of cannabinoid CB1 and CB2 receptors. *Pharmacology & Therapeutics, 74*(2), 129-180.

36. Pertwee, R. G., et al. (2010). International Union of Basic and Clinical Pharmacology LXXIX: Cannabinoid receptors and their ligands: Beyond CB(1) and CB(2). *Pharmacological Reviews, 62*(4), 588-631.

37. Carliner, H., et al. (2017). Cannabis use, attitudes, and legal status in the U.S.: A review. *Preventive Medicine, 104*, 13-23.

38. Elsohly, M. A., & Slade, D. (2005). Chemical constituents of marijuana: The complex mixture of natural cannabinoids. *Life Sciences, 78*(5), 539-548.

39. Huestis, M. A. (2007). Human cannabinoid pharmacokinetics. *Chemical Biodiversity, 4*(8), 1770-1804.

40. U.S. Food and Drug Administration. (2025). *FDA regulation of cannabis and cannabis-derived products, including cannabidiol (CBD).* Retrieved from https://www.fda.gov/news-events/public-health-focus/fda-regulation-cannabis-and-cannabis-derived-products-including-cannabidiol-cbd

41. Bhattacharyya, S., et al. (2010). Opposite effects of delta-9-tetrahydrocannabinol and cannabidiol on human brain function and psychopathology. *Neuropsychopharmacology, 35*(3), 764-774.

42. European Monitoring Centre for Drugs and Drug Addiction (EMCDDA). (2019). *Developments in the European cannabis market.* Luxembourg.

43. Tafelski, S., Hauser, W., & Schafer, M. (2016). Efficacy, tolerability, and safety of cannabinoids for chemotherapy-induced nausea and vomiting: A systematic review of systematic reviews. *Schmerz, 30*(1), 14-24.

44. Meiri, E., et al. (2007). Efficacy of dronabinol alone and in combination with ondansetron versus ondansetron alone for delayed chemotherapy-induced nausea and vomiting. *Current Medical Research and Opinion, 23*(3), 533-543.

45. U.S. Food and Drug Administration. (2006). *Cesamet (nabilone) Capsules – NDA 18-677/S-011 labeling.* Retrieved from https://www.accessdata.fda.gov/drugsatfda_docs/label/2006/018677s011lbl.pdf

46. U.S. Food and Drug Administration. (2017). *MARINOL (dronabinol) Capsules – Prescribing Information.* Retrieved from https://www.accessdata.fda.gov/drugsatfda_docs/label/2017/018651s029lbl.pdf

47. Sloan, M. E., et al. (2017). The endocannabinoid system as a target for addiction treatment: Trials and tribulations. *Neuropharmacology, 124*, 73-83.

48. Longo, R., Oudshoorn, A., & Befus, D. (2021). Cannabis for chronic pain: A rapid systematic review of randomized control trials. *Pain Management Nursing, 22*(2), 141-149.

49. Petzke, F., Enax-Krumova, E. K., & Hauser, W. (2016). Efficacy, tolerability, and safety of cannabinoids for chronic neuropathic pain: A systematic review of randomized controlled studies. *Schmerz, 30*(1), 62-88.

50. Deshpande, A., et al. (2015). Efficacy and adverse effects of medical marijuana for chronic noncancer pain: Systematic review of randomized controlled trials. *Canadian Family Physician, 61*(8), e372-e381.

51. Chang, Y., et al. (2021). Medical cannabis for chronic noncancer pain: A systematic review of health care recommendations. *Pain Research and Management, 2021*, 8857948.
52. Cuttler, C., LaFrance, E. M., & Craft, R. M. (2022). A large-scale naturalistic examination of the acute effects of cannabis on pain. *Cannabis and Cannabinoid Research, 7*(1), 93-99.
53. AminiLari, M., et al. (2022). Benefits and concerns regarding use of cannabis for therapeutic purposes among people living with chronic pain: A qualitative research study. *Pain Medicine, 23*(11), 1828-1836.
54. Akgun, K., et al. (2019). Daily practice managing resistant multiple sclerosis spasticity with delta-9-tetrahydrocannabinol: Cannabidiol oromucosal spray: A systematic review of observational studies. *Journal of Central Nervous System Disease, 11*, 1179573519831997.
55. Nielsen, S., et al. (2018). The use of cannabis and cannabinoids in treating symptoms of multiple sclerosis: A systematic review of reviews. *Current Neurology and Neuroscience Reports, 18*(2), 8.
56. Filippini, G., et al. (2022). Cannabis and cannabinoids for symptomatic treatment for people with multiple sclerosis. *Cochrane Database of Systematic Reviews, 5*(5), CD013444.
57. Chang-Douglass, S., et al. (2020). Cannabis-based medicinal products: Summary of NICE guidance. *BMJ, 369*, m1108.
58. Talwar, A., et al. (2023). Clinical efficacy and safety of cannabidiol for pediatric refractory epilepsy indications: A systematic review and meta-analysis. *Experimental Neurology, 359*, 114238.
59. Black, N., et al. (2019). Cannabinoids for the treatment of mental disorders and symptoms of mental disorders: A systematic review and meta-analysis. *The Lancet Psychiatry, 6*(12), 995-1010.
60. Silva, E. A. D. J., et al. (2022). Cannabis and cannabinoid use in autism spectrum disorder: A systematic review. *Trends in Psychiatry and Psychotherapy, 44*, e20200149.
61. Lim, K., See, Y. M., & Lee, J. (2017). A systematic review of the effectiveness of medical cannabis for psychiatric, movement, and neurodegenerative disorders. *Clinical Psychopharmacology and Neuroscience, 15*(4), 301-312.
62. Orsolini, L., et al. (2019). Use of medicinal cannabis and synthetic cannabinoids in post-traumatic stress disorder (PTSD): A systematic review. *Medicina (Kaunas), 55*(9), 525.
63. Forsythe, M. L., & Boileau, A. J. (2021). Use of cannabinoids for the treatment of patients with post-traumatic stress disorder. *Journal of Basic and Clinical Physiology and Pharmacology, 33*(2), 121-132.
64. Stanciu, C. N., et al. (2021). Evidence for use of cannabinoids in mood disorders, anxiety disorders, and PTSD: A systematic review. *Psychiatric Services, 72*(4), 429-436.
65. Kafil, T. S., et al. (2018). Cannabis for the treatment of Crohn's disease. *Cochrane Database of Systematic Reviews, 11*, CD012853.
66. Kafil, T. S., et al. (2018). Cannabis for the treatment of ulcerative colitis. *Cochrane Database of Systematic Reviews, 11*, CD012954.
67. Doeve, B. H., et al. (2021). A systematic review with meta-analysis of the efficacy of cannabis and cannabinoids for inflammatory bowel disease: What can we learn from randomized and nonrandomized studies? *Journal of Clinical Gastroenterology, 55*(9), 798-809.

68. Johnson, S., Ziegler, J., & August, D. A. (2021). Cannabinoid use for appetite stimulation and weight gain in cancer care: Does recent evidence support an update of the European Society for Clinical Nutrition and Metabolism clinical guidelines? *Nutrition in Clinical Practice, 36*(4), 793-807.

69. Koppel, B. S., et al. (2014). Systematic review: Efficacy and safety of medical marijuana in selected neurologic disorders: Report of the Guideline Development Subcommittee of the American Academy of Neurology. *Neurology, 82*(17), 1556-1563.

70. Bahji, A., Meyyappan, A. C., & Hawken, E. R. (2020). Cannabinoids for the neuropsychiatric symptoms of dementia: A systematic review and meta-analysis. *Canadian Journal of Psychiatry, 65*(6), 365-376.

71. Bosnjak Kuharic, D., et al. (2021). Cannabinoids for the treatment of dementia. *Cochrane Database of Systematic Reviews, 9*, CD012820.

72. Nielsen, S., et al. (2022). Opioid-sparing effect of cannabinoids for analgesia: An updated systematic review and meta-analysis of preclinical and clinical studies. *Neuropsychopharmacology, 47*(7), 1315-1330.

73. Velayudhan, L., McGoohan, K. L., & Bhattacharyya, S. (2021). Evaluation of THC-related neuropsychiatric symptoms among adults aged 50 years and older: A systematic review and metaregression analysis. *JAMA Network Open, 4*(2), e2035913.

74. Sholler, D. J., Schoene, L., & Spindle, T. R. (2020). Therapeutic efficacy of cannabidiol (CBD): A review of the evidence from clinical trials and human laboratory studies. *Current Addiction Reports, 7*(3), 405-412.

75. Vaughn, S. E., et al. (2021). The impact of marijuana on antidepressant treatment in adolescents: Clinical and pharmacologic considerations. *Journal of Personalized Medicine, 11*(7), 653.

76. Dawson, D., et al. (2024). The prevalence of cannabis use disorders in people who use medicinal cannabis: A systematic review and meta-analysis. *Drug and Alcohol Dependence, 257*, 111263.

77. World Health Organization. (2019). *International Statistical Classification of Diseases and Related Health Problems (11th ed.).* WHO.

78. American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (5th ed.).* Arlington, VA: American Psychiatric Association.

79. Preuss, U. W., et al. (2021). Cannabis use and car crashes: A review. *Frontiers in Psychiatry, 12*, 643315.

80. Pearlson, G. D., Stevens, M. C., & D'Souza, D. C. (2021). Cannabis and driving. *Frontiers in Psychiatry, 12*, 689444.

81. Broyd, S. J., et al. (2016). Acute and chronic effects of cannabinoids on human cognition: A systematic review. *Biological Psychiatry, 79*(7), 557-567.

82. Dellazizzo, L., et al. (2022). Evidence on the acute and residual neurocognitive effects of cannabis use in adolescents and adults: A systematic meta-review of meta-analyses. *Addiction, 117*(7), 1857-1870.

83. Onaemo, V. N., Fawehinmi, T. O., & D'Arcy, C. (2021). Comorbid cannabis use disorder with major depression and generalized anxiety disorder: A systematic review with meta-analysis of nationally representative epidemiological surveys. *Journal of Affective Disorders, 281*, 467-475.

84. Sorkhou, M., Bedder, R. H., & George, T. P. (2021). The behavioral sequelae of cannabis use in healthy people: A systematic review. *Frontiers in Psychiatry, 12*, 630247.

85. Twomey, C. D. (2017). Association of cannabis use with the development of elevated anxiety symptoms in the general population: A meta-analysis. *Journal of Epidemiology & Community Health, 71*(8), 811-816.

86. Petrilli, K., et al. (2022). Association of cannabis potency with mental ill health and addiction: A systematic review. *The Lancet Psychiatry, 9*(9), 736-750.

87. Di Forti, M., et al. (2019). The contribution of cannabis use to variation in the incidence of psychotic disorder across Europe (EU-GEI): A multicentre case-control study. *The Lancet Psychiatry, 6*(5), 427-436.

88. Hasan, A., et al. (2020). Cannabis use and psychosis: A review of reviews. *European Archives of Psychiatry and Clinical Neuroscience, 270*(4), 403-412.

89. Hjorthoj, C., et al. (2023). Association between cannabis use disorder and schizophrenia stronger in young males than in females. *Psychological Medicine, 53*(15), 7322-7328.

90. D'Souza, D. C., et al. (2005). Delta-9-tetrahydrocannabinol effects in schizophrenia: Implications for cognition, psychosis, and addiction. *Biological Psychiatry, 57*(6), 594-608.

91. Athanassiou, M., et al. (2021). A systematic review of longitudinal studies investigating the impact of cannabis use in patients with psychotic disorders. *Expert Review of Neurotherapeutics, 21*(7), 779-791.

92. Schoeler, T., et al. (2016). Continued versus discontinued cannabis use in patients with psychosis: A systematic review and meta-analysis. *The Lancet Psychiatry, 3*(3), 215-225.

93. Leung, J., et al. (2020). What is the prevalence and risk of cannabis use disorders among people who use cannabis? A systematic review and meta-analysis. *Addictive Behaviors, 109*, 106479.

94. Gunn, J. K., et al. (2016). Prenatal exposure to cannabis and maternal and child health outcomes: A systematic review and meta-analysis. *BMJ Open, 6*(4), e009986.

95. Gurney, J., et al. (2015). Cannabis exposure and risk of testicular cancer: A systematic review and meta-analysis. *BMC Cancer, 15*, 897.

96. Ghasemiesfe, M., et al. (2018). Marijuana use, respiratory symptoms, and pulmonary function: A systematic review and meta-analysis. *Annals of Internal Medicine, 169*(2), 106-115.

97. Marrocco, A., et al. (2022). E-cigarette vaping-associated acute lung injury (EVALI): State of science and future research needs. *Critical Reviews in Toxicology, 52*(3), 188-220.

98. Richards, J. R., et al. (2020). The association of cannabis use and cardiac dysrhythmias: A systematic review. *Clinical Toxicology (Philadelphia), 58*(9), 861-869.

99. Yang, P. K., et al. (2022). Nonmedical marijuana use and cardiovascular events: A systematic review. *Public Health Reports, 137*(1), 62-71.

100. Patel, R. S., et al. (2020). Marijuana use and acute myocardial infarction: A systematic review of published cases in the literature. *Trends in Cardiovascular Medicine, 30*(5), 298-307.

101. DeVuono, M. V., & Parker, L. A. (2020). Cannabinoid hyperemesis syndrome: A review of potential mechanisms. *Cannabis and Cannabinoid Research, 5*(2), 132-144.

102. Lorenzetti, V., et al. (2023). Brain anatomical alterations in young cannabis users: Is it all hype? A meta-analysis of structural neuroimaging studies. *Cannabis and Cannabinoid Research, 8*(1), 184-196.
103. Senator, B., Pardal, M., & Vandam, L. (2024). Evidence synthesis of medical cannabis research: Current challenges and opportunities. *European Archives of Psychiatry and Clinical Neuroscience.*
104. Grotenhermen, F. (2003). Pharmacokinetics and pharmacodynamics of cannabinoids. *Clinical Pharmacokinetics, 42*(4), 327-360.
105. Huestis, M. A., et al. (1992). Characterization of the absorption phase of marijuana smoking. *Clinical Pharmacology & Therapeutics, 52*(1), 31-41.
106. Barrus, D. G., et al. (2016). Tasty THC: Promises and challenges of cannabis edibles. *Methods Report RTI Press, 2016*.
107. Schlag, A. K., et al. (2022). The value of real-world evidence: The case of medical cannabis. *Frontiers in Psychiatry, 13*, 1027159.
108. Schlienz, N. J., et al. (2020). Pharmacodynamic dose effects of oral cannabis ingestion in healthy adults who infrequently use cannabis. *Drug and Alcohol Dependence, 211*, 107969.
109. National Institute on Drug Abuse (NIDA). (2021). Establishing 5mg of THC as the standard unit for research.
110. Freeman, T. P., & Lorenzetti, V. (2020). 'Standard THC units': A proposal to standardize dose across all cannabis products and methods of administration. *Addiction, 115*(7), 1207-1216.
111. Pratt, M., et al. (2019). Benefits and harms of medical cannabis: A scoping review of systematic reviews. *Systematic Reviews, 8*(1), 320.
112. Graham, M., et al. (2020). Translational hurdles with cannabis medicines. *Pharmacoepidemiology and Drug Safety, 29*(10), 1325-1330.
113. Massachusetts Cannabis Control Commission. (2024). *Regulation materials.* Retrieved from https://masscannabiscontrol.com/public-documents/regulations/
114. Massachusetts Cannabis Control Commission. (2023). *935 CMR 501.000: Medical Use of Marijuana.*
115. Massachusetts Cannabis Control Commission. (2024). *Patient registration.* Retrieved from https://masscannabiscontrol.com/new-patients/register-as-a-new-patient/
116. Statista. (2023). *U.S. legal medical marijuana patients 2023, by state.* Retrieved from https://www.statista.com/statistics/585154/us-legal-medical-marijuana-patients-state/
117. Massachusetts Department of Public Health. (2024). *Medical Use of Marijuana Monthly Dashboards.*
118. Massachusetts Cannabis Control Commission. (2024). *Sales and product distribution data.* Retrieved from https://masscannabiscontrol.com/open-data/sales-and-product-distribution/
119. Massachusetts Cannabis Control Commission. (2022). *Cannabis use trends in Massachusetts: Findings from the International Cannabis Policy Study, 2019 and 2020 – A legislative report and considerations.*

120. Kilmer, B., & MacCoun, R. J. (2017). How medical marijuana smoothed the transition to marijuana legalization in the United States. *Annual Review of Law and Social Science, 13*(1), 181-202.
121. Massachusetts Cannabis Control Commission. (2024). *Reissued order allowing for telehealth consultations for patients.* Retrieved from https://masscannabiscontrol.com/2023/02/reissued-order-allowing-for-telehealth-consultations-for-patients/
122. Massachusetts Cannabis Control Commission. (2024). *Cannabis Control Commission regulatory reforms to support delivery, testing, transportation, small business expansion, and patient access in the Commonwealth are now in effect.* Retrieved from https://masscannabiscontrol.com/2024/11/cannabis-control-commission-regulatory-reforms-to-support-delivery-testing-transportation-small-business-expansion-and-patient-accesss-in-the-commonwealth-are-now-in-effect/
123. Lapen, K., et al. (2024). Patient out-of-pocket costs for cannabis use during cancer treatment. *Journal of the National Cancer Institute Monographs, 2024*(66), 305-312.
124. Cook, A. C., Sirmans, E. T., & Stype, A. (2023). Medical cannabis laws lower individual market health insurance premiums. *International Journal of Drug Policy, 119*, 104143.
125. Minnesota Department of Health, Office of Medical Cannabis. (2016). *Minnesota medical cannabis program: Patient experiences from the first program year.* Minnesota Legislative Reference Library.
126. Hrdinová, J. (2022). Ohio medical marijuana control program at four years: Evaluating satisfaction and perception. *Ohio State Legislative Studies Research Paper, 2022*(732).
127. Kimless, D., et al. (2022). An observational cross-sectional survey exploring the indications for and responses to medical marijuana use in certified patients in Pennsylvania. *Journal of Primary Care & Community Health, 13*, 21501319221129734.
128. Reed, M. K., et al. (2022). A failure to guide: Patient experiences within a state-run cannabis program in Pennsylvania, United States. *Substance Use & Misuse, 57*(4), 516-521.
129. Massachusetts Patient Advocacy Alliance, Inc. (2024). *Massachusetts medical marijuana financial aid.* Retrieved from https://compassionforpatients.com/help/
130. Massachusetts Patient Advocacy Alliance, Inc. (2024). *Massachusetts medical marijuana dispensaries and patient assistance programs.* Retrieved from https://compassionforpatients.com/medicine/
131. Massachusetts Patient Advocacy Alliance, Inc. (2024). *Frank's Friends Initiative.* Retrieved from https://compassionforpatients.com/franks-friends-initiative/
132. Substance Abuse and Mental Health Services Administration (SAMHSA). (n.d.). *Substance Abuse and Mental Health Services Administration (SAMHSA).* Retrieved from https://www.samhsa.gov/data/data-we-collect/nsduh-national-survey-drug-use-and-health
133. Centers for Disease Control and Prevention (CDC). (n.d.). *Behavioral Risk Factor Surveillance System (BRFSS).* Retrieved from https://www.cdc.gov/brfss/
134. Centers for Disease Control and Prevention (CDC). (n.d.). *National Health and Nutrition Examination Survey (NHANES).* Retrieved from https://www.cdc.gov/nchs/nhanes/
135. Massachusetts Department of Public Health. (2019). *Marijuana baseline health study.*

136. Pacula, R. L., & Smart, R. (2017). Medical marijuana and marijuana legalization. *Annual Review of Clinical Psychology, 13*, 397-419.

137. Harrison, L., & Hughes, A. (1997). Introduction—the validity of self-reported drug use: Improving the accuracy of survey estimates. *NIDA Research Monograph, 167*, 1-16.

138. Lau, N., et al. (2015). Responsible and controlled use: Older cannabis users and harm reduction. *International Journal of Drug Policy, 26*(8), 709-718.

139. Bottorff, J. L., et al. (2013). Perceptions of cannabis as a stigmatized medicine: A qualitative descriptive study. *Harm Reduction Journal, 10*, 2.

140. King, D. D., et al. (2024). The role of stigma in cannabis use disclosure: An exploratory study. *Harm Reduction Journal, 21*(1), 21.

141. Geissler, K. H., et al. (2020). Evaluation of availability of survey data about cannabis use. *JAMA Network Open, 3*(6), e206039.

142. National Academies of Sciences, Engineering, and Medicine. (2024). *Cannabis policy impacts public health and health equity.* Washington, DC: The National Academies Press.

143. Massachusetts Department of Public Health. (n.d.). *Public Health Data Warehouse (PHDW).* Retrieved from https://www.mass.gov/public-health-data-warehouse-phd/

144. Massachusetts Center for Health Information and Analysis (CHIA). (n.d.). *CaseMix Data.* Retrieved from https://www.chiamass.gov/case-mix-data/

145. Massachusetts Center for Health Information and Analysis (CHIA). (n.d.). *Massachusetts All-Payer Claims Database (APCD).* Retrieved from https://www.chiamass.gov/ma-apcd/

146. Massachusetts Cannabis Control Commission. (2024). *Seed-to-sale tracking.*

147. U.S. Food and Drug Administration. (2017). *Drug Supply Chain Security Act.* Retrieved from https://www.fda.gov/drugs/drug-supply-chain-integrity/drug-supply-chain-security-act-dscsa

148. Massachusetts Cannabis Control Commission. (n.d.). *Research.* Retrieved from https://masscannabiscontrol.com/research/

149. Massachusetts Cannabis Control Commission. (2024). *The state of cannabis in Massachusetts.* Retrieved from https://masscannabiscontrol.com/wp-content/uploads/2024/04/The-State-of-Cannabis-in-Massachusetts-2024.pdf

150. Schauer, G. L. (2021). Cannabis policy in the United States: Implications for public health. *Journal of the National Cancer Institute Monographs, 2021*(58), 39-52.

151. Massachusetts Cannabis Control Commission. (2024). *Massachusetts Cannabis Control Commission approves final license for Commonwealth's first marijuana research facility.* Retrieved from https://masscannabiscontrol.com/2024/11/massachusetts-cannabis-control-commission-approves-final-license-for-commonwealths-first-mairjuana-research-facility/

152. Kritikos, A. F., & Pacula, R. L. (2022). Characterization of cannabis products purchased for medical use in New York State. *JAMA Network Open, 5*(8), e2227735.

153. Kaufmann, C. N., et al. (2022). Patterns of medical cannabis use among older adults from a cannabis dispensary in New York State. *Cannabis and Cannabinoid Research, 7*(2), 224-230.

154. Kim, A., et al. (2019). Patterns of medical cannabis use among cancer patients from a medical cannabis dispensary in New York State. *Journal of Palliative Medicine, 22*(10), 1196-1201.

155. Tanco, K., et al. (2023). Analysis of dispensing and utilization patterns of medical cannabis products in state-licensed cannabis dispensaries. *Journal of Palliative Medicine, 26*(11), 1482-1487.

156. Nguyen, T., et al. (2023). Changes in prescribed opioid dosages among patients receiving medical cannabis for chronic pain, New York State, 2017-2019. *JAMA Network Open, 6*(1), e2254573.

157. Kritikos, A. F., et al. (2024). Medical cannabis dosing trajectories of patients: Evidence from sales data. *Clinical Therapeutics.*

158. Lyu, X., et al. (2023). Medical cannabis received by patients according to qualifying condition in a US state cannabis program: Product choice, dosing, and age-related trends. *Current Therapeutic Research, 99*, 100709.

159. Zylla, D. M., et al. (2021). A randomized trial of medical cannabis in patients with stage IV cancers to assess feasibility, dose requirements, impact on pain and opioid use, safety, and overall patient satisfaction. *Supportive Care in Cancer, 29*(12), 7471-7478.

160. Zylla, D., et al. (2018). Oncology clinicians and the Minnesota medical cannabis program: A survey on medical cannabis practice patterns, barriers to enrollment, and educational needs. *Cannabis and Cannabinoid Research, 3*(1), 195-202.

161. Anderson, S. P., et al. (2019). Impact of medical cannabis on patient-reported symptoms for patients with cancer enrolled in Minnesota's medical cannabis program. *Journal of Oncology Practice, 15*(4), e338-e345.

162. CPP Consulting. (2022). *Medical cannabis patient survey report.* Maryland Medical Cannabis Commission.

163. Sofis, M. L. M., Mackenzie, S., & Boyum, H. (2022). Examination of experiences, behaviors, and outcomes of medical cannabis patients and providers in New Mexico. *The State of New Mexico Department of Health.*

164. Alexandre, C. R. (2011). The Rhode Island medical marijuana program: An exploratory study. *Policy, Politics, & Nursing Practice, 12*(2), 104-113.

165. University of Colorado Boulder. (2025). *Center for Research and Education Addressing Cannabis and Health.* Retrieved from https://www.colorado.edu/center/reach/

166. University of Southern California, San Diego. (2025). *Center for Medicinal Cannabis Research.* Retrieved from https://www.cmcr.ucsd.edu/index.php/background

167. U.S. Department of Health and Human Services. (2022). *Guidance on the suggested use of medical cannabis.*

168. Drexel University. (n.d.). *Drexel Medical Cannabis Research Center.* Retrieved from https://drexel.edu/cannabis-research/

169. University of Utah Health. (n.d.). *Center for Medical Cannabis Research.* Retrieved from https://uofuhealth.utah.edu/center-for-medical-cannabis-research

170. Minnesota Department of Health. (2023). *Minnesota's medical cannabis program.*

171. Ananth, P., et al. (2018). Provider perspectives on use of medical marijuana in children with cancer. *Pediatrics, 141*(1), e20170559.

172. Massachusetts Cannabis Control Commission. (n.d.). *Certifying healthcare providers—requirements.* Retrieved from https://masscannabiscontrol.com/certifying-healthcare-providers/requirements/
173. Massachusetts Cannabis Control Commission. (n.d.). *Guidance for healthcare providers regarding the medical use of marijuana.* Retrieved from https://www.mass.gov/doc/guidance-for-health-care-providers-on-the-medical-use-of-marijuana-1/download
174. Boehnke, K. F., et al. (2021). Communication between healthcare providers and medical cannabis patients regarding referral and medication substitution. *Journal of Cannabis Research, 3*(1), 2.
175. Therapeutic Goods Administration (TGA). (2017). *Medicinal cannabis guidance documents.* Retrieved from https://www.tga.gov.au/medicinal-cannabis-guidance-documents
176. Health Canada. (2018). *Information for healthcare practitioners—Cannabis (Marihuana, Marijuana) and the cannabinoids.* Retrieved from https://www.canada.ca/en/health-canada/services/drugs-medication/cannabis/information-medical-practitioners/information-health-care-professionals-cannabis-cannabinoids.html
177. Department of Health, Ireland. (2020). *Clinical guidance on cannabis for medical use.*
178. PDQ® Integrative, Alternative, and Complementary Therapies Editorial Board. (2022). *PDQ cannabis and cannabinoids.* Retrieved from https://www.cancer.gov/about-cancer/treatment/cam/hp/cannabis-pdq
179. National Institute for Health and Care Excellence (NICE). (2019). *Cannabis-based medicinal products.*
180. American Academy of Neurology (AAN). (2020). *AAN position: Use of medical cannabis for neurologic disorders.* Retrieved from https://www.aan.com/advocacy/medical-cannabis-position-statement
181. The Royal Australian College of General Practitioners (RACGP). (2019). *Use of medicinal cannabis products: 2019 update.* Retrieved from https://www.racgp.org.au/advocacy/position-statements/view-all-position-statements/clinical-and-practice-management/medical-cannabis
182. International Association for the Study of Pain (IASP). (2021). *IASP Presidential Task Force on Cannabis and Cannabinoid Analgesia Position Statement. Pain, 162*, S1-S2.
183. Minnesota Department of Health. (2025). *Guidance material for health care practitioners.* Retrieved from https://mn.gov/ocm/dmc/health-care-practitioners/guidance-materials/
184. New York State Office of Cannabis Management. (n.d.). *Medical cannabis—healthcare providers.* Retrieved from https://cannabis.ny.gov/practitioners
185. Australian Centre for Cannabinoid Clinical and Research Excellence (ACRE). (2021). *NSW Cannabis Medicines Prescribing Guidance.* Retrieved from https://www.australiancannabinoidresearch.com.au/resources
186. Case, P. (2020). The NICE guideline on medicinal cannabis: Keeping Pandora's box shut tight? *Medical Law Review, 28*(2), 401-411.
187. CIBG Ministry of Health, Welfare, and Sport. (n.d.). *Office of Medical Cannabis—Doctors and pharmacists.* Retrieved from https://english.cannabisbureau.nl/doctor-and-pharmacists

188. U.S. Preventive Services Task Force (USPSTF), et al. (2020). Screening for unhealthy drug use: US Preventive Services Task Force recommendation statement. *JAMA, 323*(22), 2301-2309.

189. Bobitt, J., et al. (2019). Qualitative analysis of cannabis use among older adults in Colorado. *Drugs & Aging, 36*(7), 655-666.

190. Ishida, J. H., et al. (2020). Sources of information and beliefs about the health effects of marijuana. *Journal of General Internal Medicine, 35*(1), 153-159.

191. Merlin, J. S., et al. (2021). Analysis of state cannabis laws and dispensary staff recommendations to adults purchasing medical cannabis. *JAMA Network Open, 4*(9), e2124511.

192. Richard, E. L., et al. (2021). How medical are states' medical cannabis policies?: Proposing a standardized scale. *International Journal of Drug Policy, 94*, 103202.

193. Kruger, D. J., Kruger, J. S., & Collins, R. L. (2020). Cannabis enthusiasts' knowledge of medical treatment effectiveness and increased risks from cannabis use. *American Journal of Health Promotion, 34*(4), 436-439.

194. Braun, I. M., et al. (2022). Backgrounds and trainings in cannabis therapeutics of dispensary personnel. *JCO Oncology Practice, 18*(11), e1787-e1795.

195. Boehnke, K. F., et al. (2019). Cannabis use preferences and decision-making among a cross-sectional cohort of medical cannabis patients with chronic pain. *Journal of Pain, 20*(11), 1362-1372.

196. Massachusetts Cannabis Control Commission. (n.d.). *Massachusetts public awareness campaign, More About Marijuana: Summary and effectiveness.* Retrieved from https://masscannabiscontrol.com/wp-content/uploads/06092020_RschRpt_PAC-FINAL.pdf

197. MacCallum, C. A., & Russo, E. B. (2018). Practical considerations in medical cannabis administration and dosing. *European Journal of Internal Medicine, 49*, 12-19.

198. Gwinn, K. D., et al. (2023). Fungal and mycotoxin contaminants in cannabis and hemp flowers: Implications for consumer health and directions for further research. *Frontiers in Microbiology, 14*, 1278189.

199. Schwabe, A. L., et al. (2023). Uncomfortably high: Testing reveals inflated THC potency on retail cannabis labels. *PLoS One, 18*(4), e0282396.

200. New York State Office of Cannabis Management. (2024). *Required testing of each lot of adult-use cannabis and medical cannabis product.* Retrieved from https://cannabis.ny.gov/system/files/documents/2024/07/ocm-testing-limits-final-7-10-24.pdf

201. U.S. Pharmacopeia. (n.d.). *Supporting the quality of cannabis for medical use.* Retrieved from https://www.usp.org/dietary-supplements-herbal-medicines/cannabis

202. MacCallum, C. A., et al. (2022). A clinical framework for assessing cannabis-related impairment risk. *Frontiers in Psychiatry, 13*, 883517.

203. Cannabis Regulators Association (CANNRA). (2024). *CANNRA response to DEA DOJ proposed rule on rescheduling.*