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A Coordinated Approach to Cannabis Policy and Product Safety

Medical cannabis has been widely promoted to alleviate the symptoms of patients with cancer, chronic pain, Parkinson's disease, anxiety, insomnia, and many other conditions. But for patients, navigating the cannabis industry itself can be a major headache. Parkinson's disease (PD), for example, is listed as a qualifying condition by medical cannabis programs in 15 states, and studies report that as many as 40% of PD patients use or have used cannabis to alleviate symptoms. It's not hard to imagine a person with PD hearing from friends and reading on patient information sites or social media that cannabis might help soothe some common symptoms, including appetite loss, pain, nausea, and tremors. The patient—let's call her Jane—might mention the idea to her neurologist, who has several other patients who use cannabis but can't provide any specific guidance on dosage or administration method. The doctor does, however, recall having learned from a survey that cannabis products can be contaminated with pesticides and other contaminants, which PD patients are even more susceptible to.

Now, concerned about this revelation but still hopeful, Jane decides to go straight to the source: a dispensary. She hopes the safety of a given product will be evident from its packaging and that the budtenders might have some expertise in symptom-specific recommendations. But at the dispensary, she realizes that neither the budtenders nor the labels can help her. Turning to the internet in frustration, Jane skims article after article, all of which basically say that cannabis might help PD symptoms or it might make them worse. ChatGPT concurs. And—bonus—she learns about widespread corruption in the cannabis industry around the private labs that test for contaminants and potency.

Jane's fictional experience is not far-fetched. In fact, we—two toxicologists (Leung and Kreider) and a doctoral student (Griffith)—regularly hear versions of this story from patients with PD and other conditions. Two of us have over a decade of experience in regulatory science and have come across issues in cannabis safety professionally, and one of us previously worked part-time in a dispensary as a college student. Our experience gives us unique insight into the ways that cannabis policy, product safety, and patient guidance form a complex web of contradictions, patches, and gaps, starting at the very top. What's urgently needed is a coordinated approach to reorganize the roles of the federal government and academia; to develop national standards for product safety and cannabis production; and to train physicians—all while prioritizing patient well-being.

A contested history leads to a convoluted patchwork

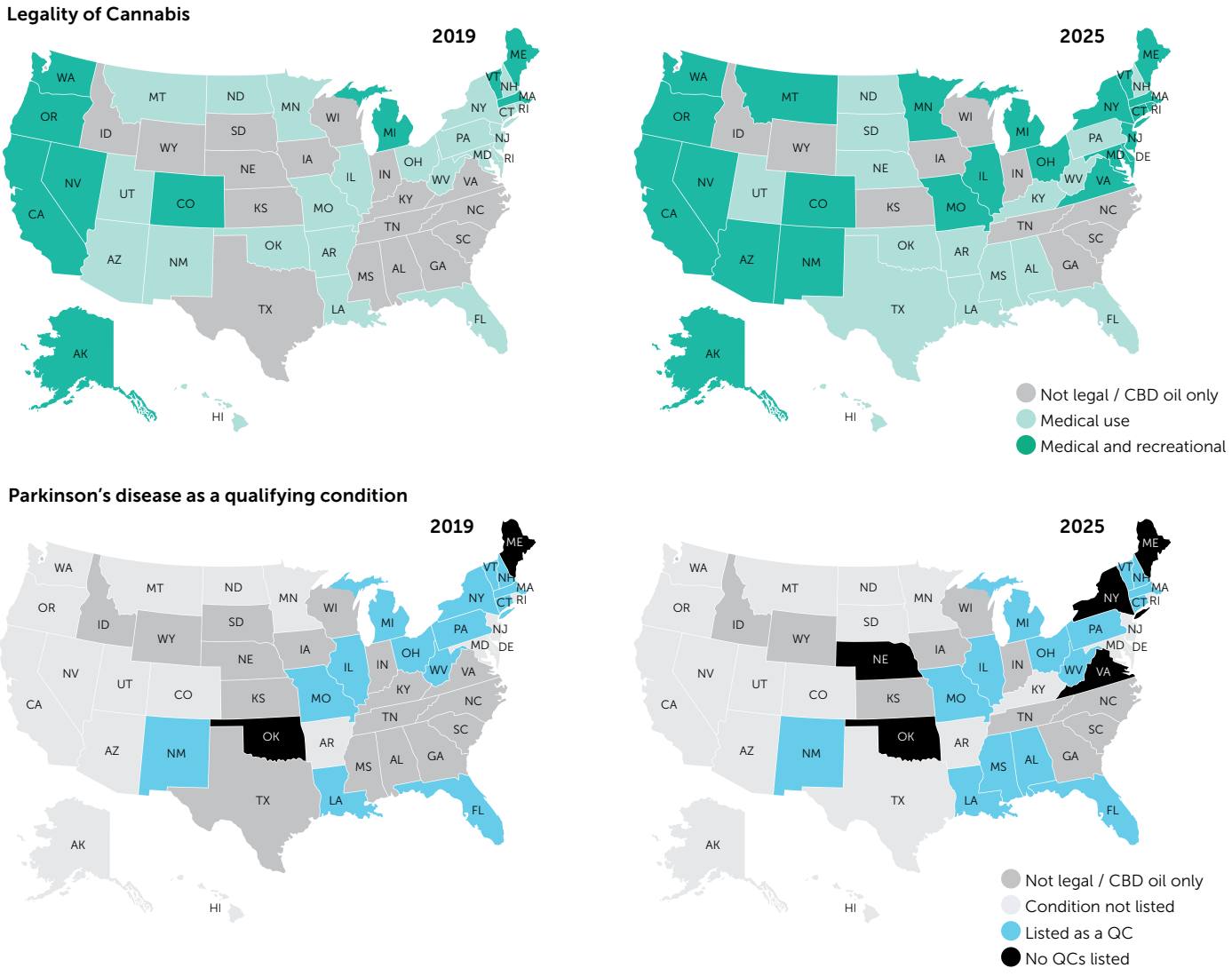
The reason patients struggle to find clarity around cannabis today reflects its contested legal history. After decades of advocates' activism at the state level, medical cannabis is now available for purchase by patients with qualifying medical conditions in 40 states, four territories, and the District of Columbia. However, at the federal level, cannabis remains classified as a Schedule I substance. Along with LSD, ecstasy, methaqualone, peyote, heroin, and other substances, cannabis is federally deemed to have no accepted medical use and a high potential for abuse. Furthermore, a shifting menu

of state-by-state regulations determines what conditions qualify patients for medical cannabis. Figure 1 illustrates the expansion of cannabis legalization and inclusion of PD, cancer, pain, and anxiety in qualifying condition (QC) lists from 2019 to 2025. As more people gain legal access to recreational and medical cannabis, the effects of the inconsistency between federal policy and patient care are compounding.

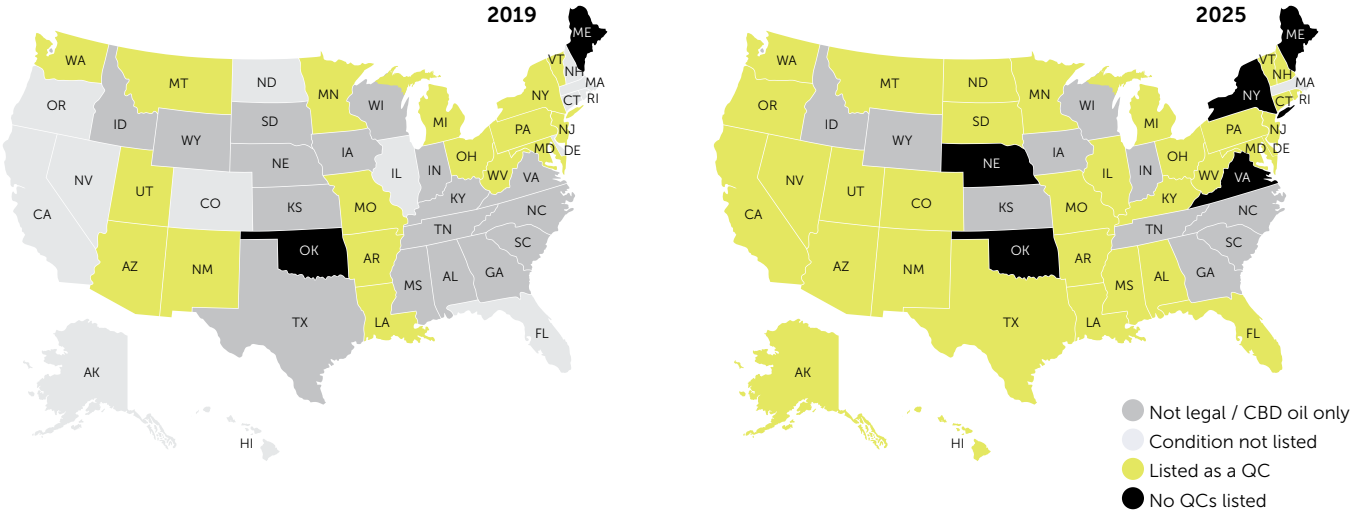
However, efforts are underway to change the federal status of cannabis. In October 2022, the Biden administration requested that the US Department of Health and Human Services (HHS) and the Drug Enforcement Administration (DEA) review the Schedule I classification of cannabis under the Controlled Substances Act. In May 2024, the Department of Justice (DOJ; the DEA's departmental home, which has congressionally mandated authority over the substances scheduled under the act) issued a proposed rule supported by both the DEA and HHS to move cannabis from Schedule I to Schedule III. After review by the Office of Management and Budget (OMB), the proposed rule was opened for public comment. On August 11, 2025, President Trump commented on the rescheduling of cannabis, saying that a decision should be expected within "the next few weeks." If the rescheduling is finalized, cannabis would still be federally controlled—but it would be officially recognized for medical use, allowing doctors and researchers to accelerate cannabis research.

The roots of the current system date back to the early twentieth century, when state-level prohibition began on a

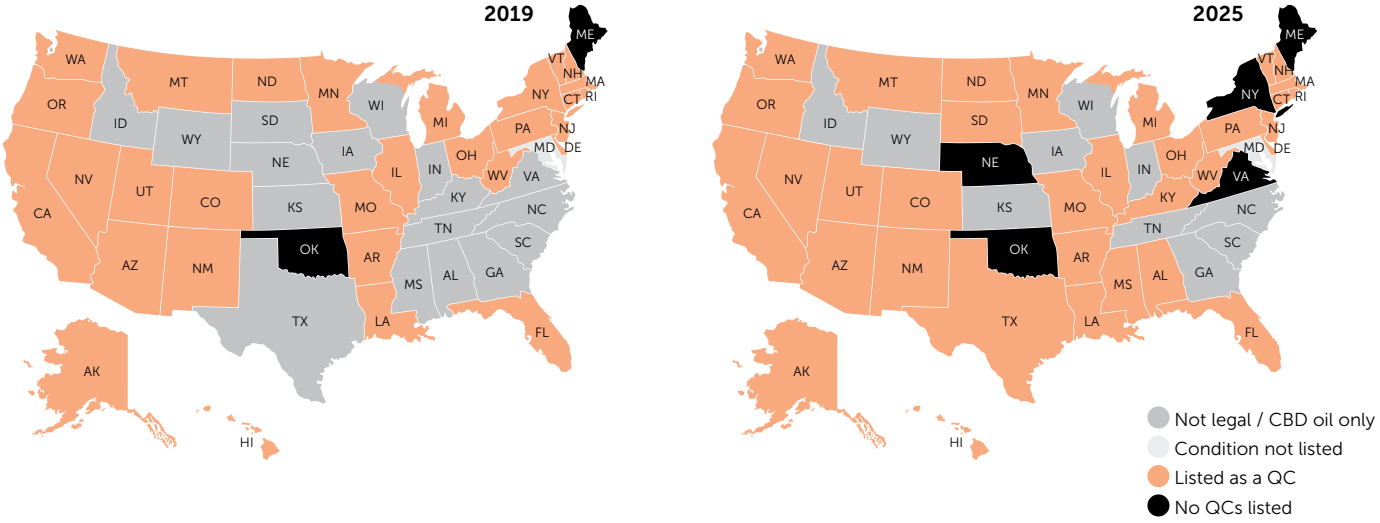
Figure 1. **CANNABIS LEGALIZATION STATUS AND SELECTED QUALIFYING CONDITIONS FOR APPROVED MEDICAL USE**



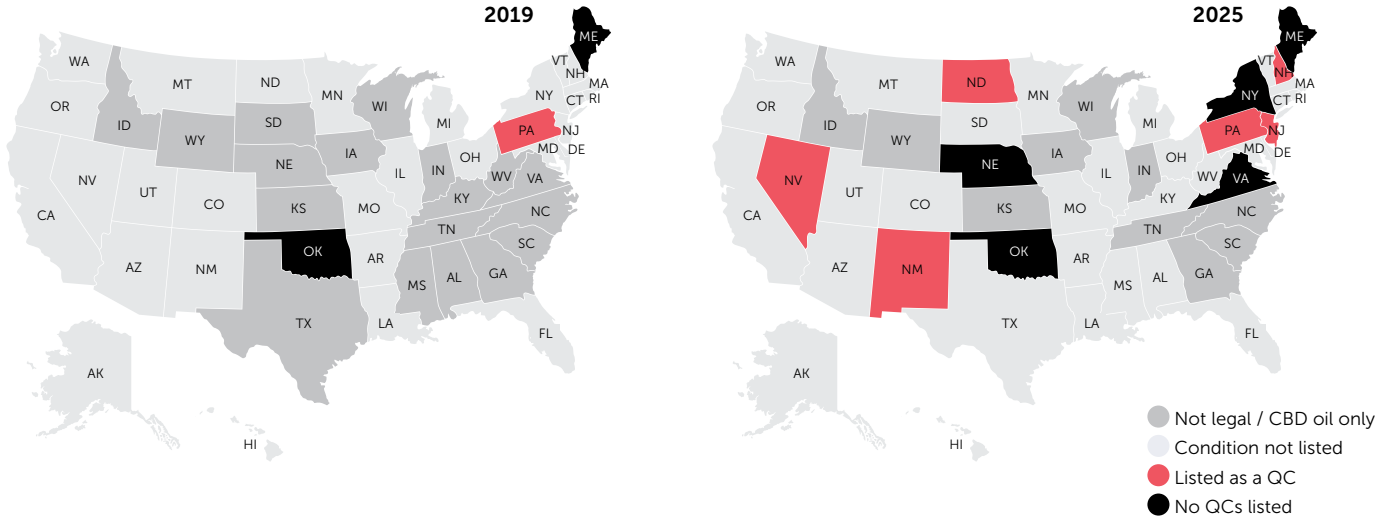
Pain as a qualifying condition



Cancer as a qualifying condition



Anxiety as a qualifying condition



substance that was previously legal to grow and consume. By the time federal law changed with the Marihuana Tax Act of 1937, effectively criminalizing cannabis possession and use, dozens of states had already banned it. Over the past 50 years, decriminalization and legalization efforts at the state level have resulted in today's cannabis landscape. However, more than half of the cannabis used in the United States remains either illegal or only decriminalized, and therefore unregulated.

With the states and the federal government out of sync, states have been left to develop their own regulations. This has resulted in a convoluted patchwork that is confusing for patients and providers alike. Meanwhile, lack of federal oversight during this period has had intractable and far-reaching consequences—for the cannabis industry and how it's regulated, for product safety, for scientific research on all things cannabis-related, and ultimately for the health and safety of patients.

Oversight that isn't

When medical or recreational cannabis is legalized in a state, state regulatory agencies become responsible for ensuring that products sold in legal markets are safe for consumers. Since compliance testing—rather than production standards, workforce development, and legal enforcement—is the primary policy tool used to ensure cannabis safety, independent, state-licensed laboratories have been tasked with testing cannabis batches and providing certificates of analysis detailing a product's tetrahydrocannabinol (THC) levels, also known as potency, and contaminant testing results.

One major problem with this system is that the third-party labs licensed by states to handle testing are paid by cannabis producers, not the state—creating a financial incentive to skew test results in producers' favor. Without federal oversight, many producers engage in "laboratory shopping," as one *Undark* investigation documented, sending their products to laboratories that are known to report more favorable potency or contaminant results. This problematic testing system undermines consumer trust, inflates THC percentages on product labels, and increases the possibility that contaminated products will reach immunocompromised or medically vulnerable patients.

In addition to perverse incentives in testing, each state has different requirements for compliance testing—as well as for grow practices and product labeling. California, for example, requires screening for 66 pesticides, 4 toxic elements, 20 solvents, 6 microbial pathogens, and 5 fungal toxins. Products that fail these standards are subject to recall. In contrast, some states regulate far fewer contaminants. And a product that fails testing in one state could still reach consumers via black and gray markets in the same or a different state.

Without an adequate testing regime, cannabis users are exposed to significant risks. In a 2025 study, one in every six cannabis samples in Arizona's and California's black and gray markets was found to contain the toxins and metabolites of *Fusarium* fungi, which are linked to vomiting (called cannabis hyperemesis) and opportunistic infections. Exposure to cannabis contaminants, including microbial pathogens, fungal toxins, pesticides, toxic elements, and solvents, can result in neurotoxic effects and life-threatening infections, particularly in patients who are immunocompromised or vulnerable as a result of underlying medical conditions. One type of common contaminant, organophosphate pesticides, may even be connected to the onset or acceleration of PD.

A dearth of research at universities

The holes in federal regulation are obvious. Less conspicuous is the minimal involvement of another important player: academia. The systemic problems we've described result in large part from a lack of national standards for cannabis production and safety testing. Standards, such as those in place for food, alcohol, tobacco, and pharmaceuticals sold in the United States, are normally developed with the participation of "three pillars": the public sector, the private sector, and the academic sector, with academia contributing the critical research underpinning standards. However, academic scientists' ability to study crucial questions surrounding cannabis is currently hampered by two big issues: insufficient funding and restricted access to products on which to conduct testing.

Existing funding priorities at the federal level are driven by the federal definition of cannabis as a Schedule I restricted substance, affecting what kinds of research are performed. Currently, there are over 30 cannabis research initiatives and centers at universities across the United States. However, cannabis addiction has received more attention by university researchers than cannabis safety because the National Institute on Drug Abuse (NIDA) is the primary federal sponsor of cannabis research. According to the NIH RePORTER, 72% (or $222 million) of the National Institutes of Health (NIH)'s cannabis research funding came from NIDA in fiscal year 2025. Other programs focus on the potential health benefits of cannabis, in line with the legality of cannabis use for medical purposes in many states. Yet very few programs prioritize knowledge transfer to state regulators who are responsible for cannabis safety. There is also limited systematic research on what contaminants to regulate (or not regulate). Even the question of how best to ensure cannabis safety (i.e., compliance testing versus production standards versus workforce development) remains unexplored. Other obvious questions, such as what harmful fungal contaminants are commonly found in cannabis and what levels of THC are generally regarded as safe in consumer beverage products, are also understudied.

One major reason that these questions are understudied is that it is incredibly difficult for researchers to access products. As of now, researchers need to receive a Schedule I research

registration from the DEA to conduct cannabis research. Cannabis products available from state dispensaries are not approved for research, and only one US supplier provides cannabis for research conducted by NIH grant recipients under the Controlled Substance Act. Therefore, the materials tested in funded studies are unlikely to be representative of products on the market. In particular, the prevalence and health effects of cannabis contaminants, such as pesticides, toxic elements, microbial pathogens, and mycotoxins, are largely absent in the scientific literature. The contaminant issues are even less understood in black- and gray-market cannabis.

No help at the doctor's office

The progression of states' cannabis programs without federal government involvement or clarity from the research community translates into daily safety concerns and clinical challenges for patients and providers. Many patients receive their medical cards for cannabis access but are given little to no guidance on cannabis use. They're left to self-educate through peers, independent research, or dispensary staff. Even physicians are rarely trained in this field. In a 2017 study, only one of the 45 practicing cannabis clinicians who completed the survey had received education during medical school about cannabis medicine. The others gained knowledge through conferences, the medical literature, and websites.

Federal policies regarding the drug may even be exacerbating the element of taboo still attached to cannabis use. According to one study of cancer patients, of those who used cannabis to alleviate symptoms, only 50% reported discussing cannabis use with their health care provider. Some patients may worry about labor laws and insurance policies. Health care providers who practice in large or national health networks may be less inclined to engage in cannabis conversations due to institutional expectations. Limited communication between physicians and patients about cannabis can be detrimental to patients' health, potentially leading to misinformation, unsafe usage, or missed opportunities for symptom management.

Closing the gaps

The future of cannabis policy lies at the intersection of medicine, agriculture, public health, and criminal justice. Regulation requires actions from state and federal governments, testing laboratories, physicians, research universities, the cannabis industry, and patients. But today, as illustrated in Figure 2, this system is fragmented and disconnected. Coordination among stakeholders is essential to creating a unified regulatory approach.

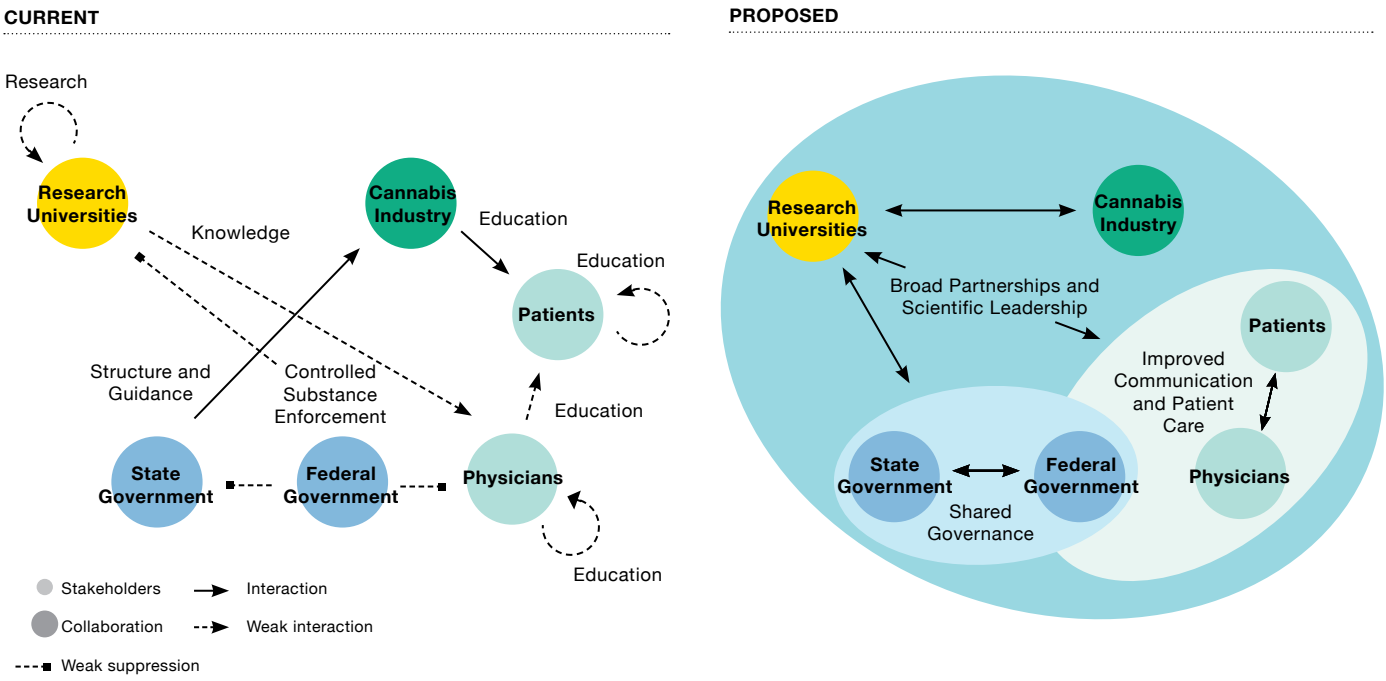
Even if the federal government changes the legal status of cannabis, there will need to be a framework for collaboration with states, similar to frameworks involving health policy. Medicaid, for example, sets a federal "floor" of minimum standards while allowing states to go above and beyond with protections. Another example is alcohol control, in which the federal regulation of product labeling and permits for manufacturers supports the local autonomy of state governments to regulate sales. Shared governance allows the federal government to have some oversight while not infringing states' rights.

A similar shared governance structure could be created for cannabis. For example, cannabis products used strictly for medical purposes might find an analogy with the drug approvals performed by the US Food and Drug Administration (FDA)—an example of a potential policy "ceiling." By contrast, for recreational cannabis products, the structure that FDA has set up for tobacco products could be used as a model to establish a policy ceiling. Both drug and tobacco approvals through FDA are cost-intensive, and application of a similar paradigm to cannabis may be burdensome for smaller companies. Nonetheless, adopting similar approaches for cannabis would allow for an approval-based process that would support appropriate manufacturing processes, provide baseline product testing guidance, and evaluate human health and environmental impacts prior to market approval. This approach could provide an effective and protective framework to enable collaboration between federal and state regulators while promoting transparency and safety.

Another important part of coordinated regulation is the establishment of standards. Happily, a number of professional societies are now working on addressing various weaknesses of the existing cannabis compliance testing system at the state level. For example, AOAC INTERNATIONAL, a nonprofit membership association of analytical science professionals, offers a proficiency testing program to address interlaboratory inconsistency. Efforts by US Pharmacopeia, a nonprofit organization focusing on the supply of safe, quality medicines, and the Cannabis Committee of ASTM International, a scientific organization of international standards, address differences in cannabis contaminant regulations between states.

However, the government and research universities are conspicuously absent from these standards development initiatives, and a lack of training standards persists for people who work in the biotechnology and analytical business of cannabis, hemp, and cannabinoids in the United States. While clearly there is interest in developing standards for cannabis safety testing, less attention is given to standards for cannabis production, such as integrated pest management (which can reduce or replace pesticide use) and good manufacturing practices (which can reduce the risk of cannabis product contamination). It is crucial that any contaminant testing standards are based on health risk assessments and existing compliance testing data. In particular, pesticide testing standards need to address the potential misuse of insecticides and fungicides in cannabis production but still allow justifiable uses in integrated pest management and fungal control.

Figure 2. **CURRENT FRAGMENTATION OF MEDICAL CANNABIS REGULATION VS. PROPOSED COORDINATED SYSTEM**



Still, product safety alone is not enough. Patients need better access to education, and providers need unbiased, up-to-date training. Meeting those needs includes recognizing the endocannabinoid system in medical curricula, funding continuing medical education programs, and ensuring dispensary staff are trained in evidence-based counseling. Development of physician, patient, and dispensary staff education programs also requires patient data. A federally funded patient research registry is currently in development at Johns Hopkins University. Eventually, the federal government and state cannabis programs should come to consensus on basic safety standards. If federal and state programs fail to establish clear safety standards, cannabis will continue to mirror broader inequities in health care, reinforcing a system in which privilege determines who benefits from safe, well-regulated access and who faces unnecessary risk.

Finally, research universities have a pivotal role to play in cannabis safety because they can provide both technical knowledge and leadership. As the cannabis market grows to include therapeutics and low-dose consumer products such as beverages, university research on safety will be essential. Furthermore, research universities are uniquely positioned to bring together public health, academic, and industry partners to provide scientific leadership in the national dialogue on cannabis safety issues. As the engine of the US bioeconomy, research universities are poised to help with both cannabis policy and product safety.

For the last 30 years, the legal status of cannabis has followed a benevolent and perhaps intentionally informal path, as state legislatures have attempted to ease patients' suffering and (in some states) legalize an already-common substance. However, regulatory informality has ceased to be appropriate as "homegrown" weed for patient use has been supplanted by sophisticated legal and gray markets. This increasingly formal market must be recognized, supported, and regulated more assertively—not only to help the patients that legalization was intended to benefit, but also to develop a regulated market that doesn't harm users. Changes at the federal level are now necessary to conduct robust research and provide sound guidance to both patients and providers. By establishing a unified framework, the United States has the opportunity to set a global standard for safe, evidence-based cannabis regulation.

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