

Research Paper

Public health orientation of Cannabis and alcohol regulators: An analysis of state-level variation in the United States

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ABSTRACT

Objectives: To provide an analysis of state-level variation in how alcohol and adult-use cannabis regulatory agencies articulate their involvement in, and pursuit of, public health goals.

Methods: An important slogan in state-level campaigns to legalize adult-use cannabis was to regulate cannabis “like alcohol.” We conducted a content analysis of annual reports produced by state cannabis and alcohol regulatory agencies in the United States where adult-use cannabis has been legalized to compare the reported public health orientations of each agency. Our coding domains capture references to (1) stated public health goals, (2) data collaboration with public health agencies, (3) public health efforts, and (4) law enforcement efforts.

Results: Adult-use cannabis regulatory agencies reported all public health indicators more often, while alcohol regulatory agencies reported engaging in law enforcement efforts more often than cannabis regulators. Compared to states that legalized adult-use cannabis through ballot initiatives, states that legalized through their legislatures reported more public health indicators for both cannabis and alcohol regulators. We find a positive correlation within states between the public health engagement of alcohol and cannabis regulators.

Conclusions: Cannabis regulatory agencies largely outperform alcohol regulatory agencies in terms of their articulated public health goals, activities, and policies. US states adopting adult-use cannabis legalization more recently, have predominantly legalized through their state legislatures and have cannabis regulators that report on a greater number of cannabis-related public health issues. More research is needed to assess whether public health-related actions reported by cannabis agencies translate into tangible public health benefits among cannabis using and affected populations.

Introduction

An important slogan in the campaign for legalization of cannabis for adult use was “Regulate like alcohol” (Caulkins, 2017; Caulkins & Kilborn, 2019; Caulkins, Kilmer et al., 2012; Caulkins, Lee et al., 2012; MacDonald, 2015). For many public health scholars this was an ironic banner under which to march. Alcohol regulation is regarded within the public health community as largely a failure, and sometimes even as, an example of regulatory capture by the industry it regulates (Cook, 2007; Noel et al., 2017; Room, 1984; Savell et al., 2016). Alcohol-related health consequences and mortality remain among the leading preventable causes of death in the United States (US) (Centers for Disease Control and Prevention [CDC], 2024).

Several studies have found the legalization of adult-use cannabis to

be associated with increases in the prevalence of cannabis use as well as the extent of frequent and high intensity use, particularly among males and those of low-income status (Goodman et al., 2020; Goodwin & Silverman, 2024; Hasin et al., 2019; Jeffers et al., 2021; Kephart et al., 2025; Lapham et al., 2023). A burgeoning literature also suggests that increases in prevalence and high frequency use may come with notable public health consequences, including increases in the prevalence of Cannabis Use Disorder (CUD) (Smart & Pacula, 2019; Patrilli et al., 2022), neurocognitive deficits (Dellazizzo et al., 2021), hyperemesis (Karila et al., 2014), and psychosis (Patrilli et al., 2022).

Historically, the regulatory regimes of alcohol and adult-use cannabis both proceeded from prohibition regimes, which provided a blank slate for substance regulation. Following Prohibition, US states pursued varied approaches to alcohol regulatory regimes: 15 states took

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on public monopoly, or Alcohol Beverage Control (ABC), models where states own and operate the sale of alcohol while the remainder eventually took up for-profit regulatory models that permit the operation of private liquor establishments (Levine & Reinerman, 1991; Pennock & Kerr, 2007; Room, 1984). By contrast, among the 24 US states that have legalized the sale and consumption of adult-use cannabis, all have established a for-profit model of business licensing that parallels the present-day status of for-profit state liquor and alcohol licensing regimes. The ubiquity of the for-profit commercial model reflects the framing of adult-use cannabis as a novel revenue source within legalization debates (Orenstein & Glantz, 2020).

Additionally, unlike the nationwide repeal of Prohibition passed by way of constitutional amendment, adult-use cannabis legalization has only been enacted at the state level. The most popular modes of legalization include citizen-led ballot initiatives and referenda (hereafter “ballot measures”) and state legislation. Only 26 US states and Washington DC have a ballot initiative or referendum process available to constituents (Adams, 2012). Accordingly, an increasing number of states have turned to the legislative process to pursue legalization.

Internationally, countries have taken a broad array of approaches to adult-use cannabis regulation. In Canada, which legalized adult-use cannabis in 2018, provinces were given considerable discretion in their regulatory frameworks (Shanahan & Cyrenne, 2021). Alberta and Saskatchewan, for instance, pursued a similar for-profit licensing model as US states and integrated their cannabis regulatory agency into extant alcohol and gambling regulatory agencies. Quebec, on the other hand, operates the Quebec Cannabis Corporation (SQDC), a provincially-controlled firm with a legal monopoly over the distribution and sale of cannabis. Uruguay, the first country to legalize the sale and consumption of adult-use cannabis, maintains a state-controlled regime with strict price and production levels, a limited number of commercial pharmacies, and “cannabis clubs,” not-for-profit cooperatives that can distribute cannabis to small groups of registered individuals, as well as home grown for personal use (Obradovic, 2021; Walsh & Ramsey, 2015).

Compared to the robust body of literature on alcohol regulation, there is a small literature on what responsible adult-use cannabis regulation might entail. Blanchette et al. (2022) assessed 18 different policy choices, whether for regulators or for other kinds of policy makers, for their potential in “reducing youth use of cannabis, excessive cannabis use among the general population, and cannabis-impaired driving.” Most of the policies that were rated highly in all three dimensions were options for adoption specifically by cannabis regulators, such as physical retail availability and retail price restrictions. Moreover, research on the potential regime directions that cannabis regulation may take has broadly assumed a consensus that countries and US states which take a control-oriented approach to market regulation are best suited to address the potential public health and safety consequences of legalization (Blanchette et al., 2022; Crawford, 2023; Kilmer, 2014; Kilmer, 2017; Neely & Richardson, 2023).

Research demonstrates that there is significant variation in both the means and extent to which US states regulate issues of public health for regulated substances, such as alcohol and tobacco (Dobbs et al., 2021; Mosher et al., 2013; Neely & Richardson, 2023). Barry and Glantz (2018) find that the policy texts of the first four states to legalize adult-use cannabis followed the language of alcohol regulation; among these states, less than half of all cannabis-use legislation, including general, supply-side, and demand-reduction policies, adhered to public health “best practices.”

Moreover, there is significant variation in the location of agencies placed in charge of adult-use cannabis regulation within state governments. Three states, Washington, Oregon, and Maryland, place cannabis and alcohol under the same regulatory agencies. All other states have either created an independent regulatory agency or have nested the responsibilities of cannabis regulation within extant departments. [Appendices A1 and A2](#) provides details on the regulatory body for adult-

use cannabis and alcohol for all states which have legalized adult-use cannabis. Nearly half of states (46 %) have created independent executive bodies for the regulation of adult-use cannabis. Among US states where adult-use cannabis regulation is housed within existing state departments, over half of cannabis regulatory bodies are located within finance and licensing departments. A similar makeup is found with respect to alcohol regulation, with 39 % of alcohol agencies operating as independent regulatory bodies and 39 % located under licensure and finance departments. Only approximately 20 % of both adult-use cannabis and alcohol regulatory bodies are located under the supervision of public health or public safety departments.

Notwithstanding trends in the administrative placement of alcohol regulators, efforts of alcohol regulators are regularly considered both in the context of public health and public safety (Room, 1984). Underage access to alcohol and the prevalence of intoxicated driving are issues of significance to both regulators and law enforcement, and their prevention efforts often occur in tandem (Edwards & Holder, 2000). The most common arguments against adult-use cannabis legalization contend that driving under the influence and underage access to cannabis will increase under a legalization framework (McGinty et al., 2017), indicating that these issues which blur the line between public health and safety are of relevance to alcohol and adult-use cannabis regulatory agencies alike (Anupriya et al., 2025).

Early advocacy for adult-use cannabis legalization largely proposed maintaining the frameworks set by alcohol regulation, reflecting heavy emphasis on revenue production and limited public health consideration (Hall et al., 2019). As the number of adult-use cannabis markets has risen and the modes by which cannabis is legalized have diversified, the question remains whether more recent US states to legalize have pursued similar regulatory approaches. The goals of the present study are to explore variation in state agency-reported public health orientation and articulated goals across two dimensions: within-state variation across state alcohol and adult-use cannabis agencies and between-state variation across characteristics of adult-use legalization efforts, including the timing and method of legalization. This analysis is an initial effort with regards to a broader research agenda towards understanding the extent to which adult-use cannabis regulatory agencies are regulating or operating within a public health framework.

Methods

In the United States, all 50 states regulate alcohol, 38 have medical cannabis programs, and 24 have established adult-use cannabis markets as of July 2025. These 24 states that have are the focus of our study. After identifying the principal regulatory agency for alcohol and cannabis for each state (see [Appendices A2 and A3.](#)), both agencies’ websites were searched for published annual reports. The most recent annual report available on the agency’s website was collected. Annual reports were selected as the primary document of analysis for two reasons. Typically submitted to state legislatures, annual reports provide an overview of both the actual and expected operations of each agency. Additionally, because reports are often submitted on a semi-regular basis, they provide the most reliable and recent source of information on agency activity. It is important to note that in many states, legislatures direct the content of agency reports. While some states dictate a comprehensive list of outcomes regulatory agencies are expected to report on, the most common language involves directing regulators to report on their “past-year activities,” providing regulators discretion in what they report.

In total there are 45 agencies that regulate alcohol or adult-use

cannabis across the 24 states that have legalized adult-use recreational cannabis markets.¹ Reports were located for 22 of the 24 adult-use cannabis regulatory agencies (92 %) and 20 of the 23 alcohol regulatory agencies (87 %) among the 24 states with existing adult-use cannabis policies. Only one state, Alaska, had neither a cannabis nor alcohol regulatory report. Appendix A2-A4 provide further information on each regulatory agency and report availability. Drawing from prior research, we conducted content analyses on the reports, deductively coding for the presence of three concepts, each indicating an increasing commitment to substance-related health and safety outcomes (Bero et al., 2023; Dellazizzo et al., 2021; Petrilli et al., 2022). First, we identified whether a state agency reports an interest in public health or safety in their mission statement or agency goals. Mission statements on agency websites were consulted for those that did not list their mission statement within the report. Second, we coded whether the cannabis or alcohol regulatory agency indicated any active collaboration with any other state-level agencies to collect data on public health and safety outcomes, such as cannabis and alcohol use disorder prevalence. Frequently reported collaborating agencies include departments of public health, education, or law enforcement agencies. Finally, we coded whether the cannabis or alcohol regulatory agency reported collaborative or independent efforts to address any of the public health and safety outcomes listed in Table 1. Examples include efforts such as working with law enforcement to crackdown on liquor license violations (e.g., selling to underage buyers) for public safety or developing a youth education campaign on cannabis use with a public health agency. Data were also collected on the characteristics of each state's cannabis legalization process, including the year of legalization and method through which adult-use cannabis was legalized (see Fig. 1). Results are compared across the timing and method of adult-use cannabis legalization.

Results

The prevalence of public health and safety indicators reported by alcohol and cannabis regulators varies both within and across states, but there is more variation between states in the indicators reported than within when comparing states' alcohol and cannabis reports. We take

Table 1
Public health and safety domains coded for in each US state agency report.

	Cannabis outcomes	Alcohol outcomes
Public Health Outcomes	Total cannabis consumption prevalence among adults (21+)	Total alcohol consumption prevalence among adults (21+)
	Youth (under 21) cannabis consumption prevalence	Youth (under 21) alcohol consumption prevalence
	Cannabis-related emergency department admissions	Alcoholism or alcohol use disorder treatment admissions
	Cannabis use disorder treatment admissions	Alcohol-related emergency department admissions
		Liver cirrhosis prevalence
Public Safety Outcomes	Cannabis-involved driving under the influence (DUI) prevalence	Alcohol-involved driving under the influence (DUI) prevalence
	Cannabis-involved minor in possession offenses	Alcohol-involved minor in possession offenses
	Cannabis license violations (e.g., testing misreporting, sale to minors)	Alcohol license violations (e.g., sale to minors, health code violations)

¹ Two states contain offices that report on both alcohol and adult-use cannabis activities (Washington and Oregon) and one state delegates alcohol control to local governments (Nevada). Forty out of the 45 adult-use cannabis and alcohol regulatory agencies are included in this analysis (89 %).

these explicit measures to reflect differences in the priority states place on public health and safety goals related to these markets. Table 2 displays the prevalence of each public health and safety indicator in adult-use cannabis and alcohol regulatory agencies' most recent annual report. On average, cannabis reports tended to more explicitly articulate public health goals. Over two-thirds (68 %) of cannabis reports mentioned public health in the agencies' mission statement or directive, while only 35 % of alcohol reports did the same. Similarly, a greater number of cannabis agencies reported some form of collaboration with public health and other state agencies to collate cannabis-related public health data and independently pursued their own public health initiatives, including substance use education, outreach, and prevention programming. Appendix A5, provides further detail on the specific public health and safety efforts pursued by each agency. Alcohol agencies report participation in law enforcement efforts slightly more often than cannabis regulators (64 % vs. 70 %); however, the difference in prevalence is practically negligible. While cannabis regulatory agencies were most likely to list public health as an agency objective, law enforcement collaboration and participation were the most common action reported by both adult-use cannabis and alcohol agency reports. Cannabis regulator reports were almost 20 % more likely to mention collaborations with law enforcement than public health agencies, while alcohol regulators were 40 % more likely. Efforts to crack down on driving under the influence (DUI), illicit liquor and cannabis markets, and license violations for underage sales were the most common types of law enforcement collaborations reported.

Table 3 displays a within-state cross-tabulation of the total number of public health and safety indicators included in each state's adult-use cannabis and alcohol regulatory agency report. These data corroborate the finding that adult-use cannabis agencies report on public health efforts and initiatives more frequently than alcohol agencies. On average, adult-use cannabis reports articulate a greater number of public health and safety indicators when compared to their state alcohol report. While 33 % of cannabis reports met at least three out of four indicators, only 21 % of alcohol regulators did the same. Additionally, Table 3 indicates a moderately positive correlation (*Spearman's rho* = 0.35) between the number of public health indicators reported by alcohol and cannabis regulators. States with at least one agency that reports few public health and safety indicators are more likely to yield fewer indicators by their other agency's report.

Noticeable differences are observed when examining the difference in reported actions through the means by which a state effectuated adult-use cannabis legalization. Table 4 separates agency reports by the method of adult-use cannabis legalization: ballot measure (i.e., citizen initiative) or state legislation. States which legalized adult-use cannabis through their state legislatures, instead of by way of ballot initiative, provided adult-use cannabis agency reports which were more likely to contain explicitly stated agency goals of pursuing cannabis-related public health outcomes (State Legislation: 88 %; Ballot Measure: 57 %), collaborating with other state agencies on data collection efforts (SL: 50 %; BM: 29 %), and engaging in public health efforts (SL: 50 %; BM: 43 %). States were equally likely to report participation in law enforcement efforts to curb license violations as well as illicit cannabis use and sales (SL: 63 %; BM: 64 %).

States that legalized the consumption and sale of adult-use cannabis through state legislation, opposed to through citizen-led initiative, reported almost all public health and safety indicators more often for *both cannabis and alcohol regulatory agencies*. As displayed in Table 4, in states which legalized adult-use cannabis through state legislation, alcohol regulatory reports articulated public health goals and reported participation in public health and safety initiatives at a greater prevalence than alcohol regulatory agencies from states which legalized cannabis through ballot measure. The only exception is alcohol regulators' prevalence of reporting engaging in data sharing with public health organizations, where 17 % of states that legalized adult-use cannabis via ballot initiative reported having done so, compared to 13 % of states that

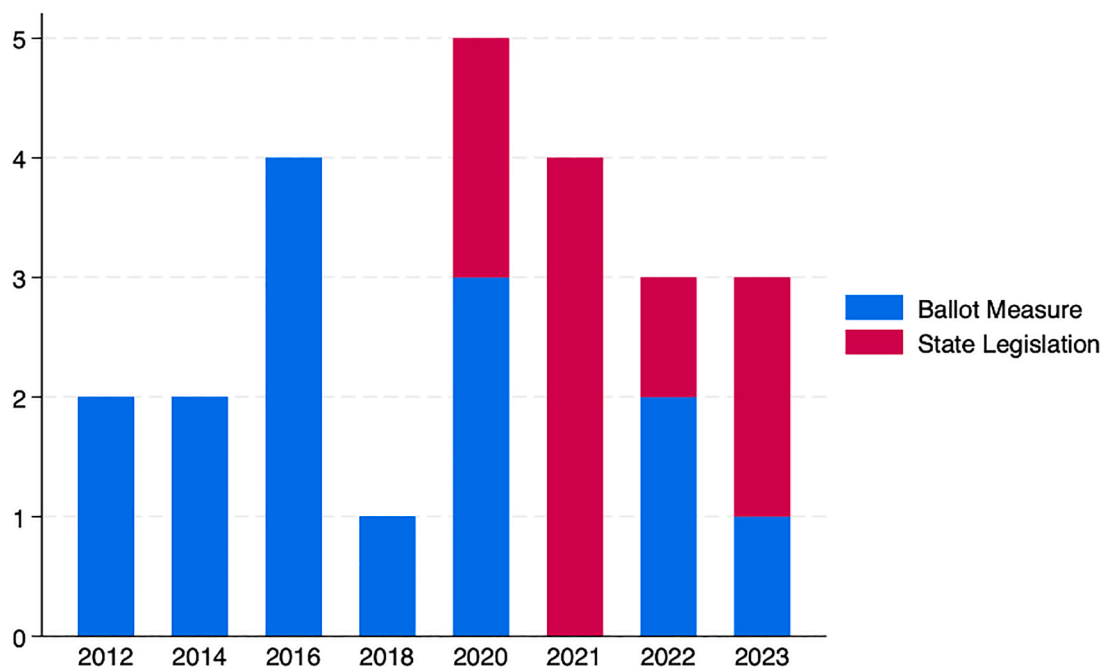


Fig. 1. Timing and method of adult-use cannabis legalization among US states (2012 – 2025).

Table 2
Public health and safety indicator prevalence in state regulatory reports.

	Cannabis			Alcohol		
	Yes	No	%	Yes	No	%
Articulated Public Health Goals	15	7	68 %	7	13	35 %
Data Collaboration with Public Health Agencies	8	14	36 %	3	17	15 %
Agency Public Health Efforts	10	12	46 %	6	14	30 %
Agency Law Enforcement Efforts	14	8	64 %	14	6	70 %
	N = 22			N = 20		

legalized adult-use cannabis through state legislatures.

Discussion

State-level campaigns in the United States towards the legalization of adult-use cannabis emphasized a comparison with alcohol regulation, despite alcohol regulatory agencies’ poor reputation for paying attention to, and acting on, the health consequences of alcohol consumption. We find that adult-use cannabis agencies prioritize the public health components of their regulatory task more than their alcohol regulatory counterparts. This conclusion comports with existing findings that in Colorado and California, cannabis is typically regulated more strictly

Table 3
Public health and safety indicator scores within US states that have legalized adult-use cannabis.

	Cannabis regulatory agency report public health indicators mentioned							Total
	0	1	2	3	4	NA		
Alcohol Regulatory Agency Report Public Health Indicators Met	0	4, (16.7 %)	0, (0 %)	1, (4.2 %)	0, (0 %)	1, (4.2 %)	0, (0 %)	6, (25 %)
	1	0, (0 %)	2, (8.3 %)	0, (0 %)	1, (4.2 %)	3, (12.5 %)	0, (0 %)	6, (25 %)
	2	0, (0 %)	0, (0 %)	2, (8.3 %)	0, (0 %)	0, (0 %)	0, (0 %)	2, (8.3 %)
	3	1, (4.2 %)	1, (4.2 %)	0, (0 %)	0, (0 %)	1, (4.2 %)	1, (4.2 %)	3, (12.5 %)
	4	0, (0 %)	0, (0 %)	0, (0 %)	1, (4.2 %)	1, (4.2 %)	0, (0 %)	2, (8.3 %)
	NA	0, (0 %)	1, (4.2 %)	1, (4.2 %)	1, (4.2 %)	0, (0 %)	1, (4.2 %)	3, (12.5 %)
Total	5	4, (16.7 %)	4, (16.7 %)	3, (8.3 %)	6, (25 %)	2, (8.3 %)	24, (100 %)	

than alcohol (Crusto et al., 2022; MacDonald, 2015; Matthey et al., 2023). Notably, we find that legalization accomplished through state legislation, rather than ballot initiative, was associated with substantially greater regulatory attention to public health outcomes. Even so, a notable proportion of cannabis regulatory agencies did not report participating in public health efforts (54 %) or joint efforts with agencies that collect public health data (64 %). Both alcohol and cannabis regulators were also more likely to report on law enforcement efforts than public health efforts.

There are several confounders that complicate the interpretation of the relationship between the method of adult-use cannabis legalization and public health attentiveness. First, the enactment of adult-use cannabis legalization through state legislatures is a relatively recent phenomenon. 7 of the 9 states that legalized adult-use cannabis through legislation occurred after 2021. The use of ballot measures, and other citizen-led initiatives, became substantially less common during this period, with only 2 of 15 cannabis legalization ballot initiatives having passed since 2021. Recent adopters of legal, adult-use cannabis, who have legalized disproportionately through state legislation, had more examples to draw from and were able to learn from the initial missteps of early adult-use cannabis adopters.

A second confounder is the intentionality with which US states pursue adult-use cannabis legalization. By nature of the mechanism, state legislatures amending and adopting ballot initiatives have less of a say and receive far less time to consider and build a complex, public health-oriented regulatory agency, than if they were to pursue legalization of their own accord. Adult-use cannabis campaigns, particularly

Table 4
Public health and safety indicator prevalence by state method of adult-use cannabis legalization.

Method of Adult-Use Cannabis Legalization	Cannabis		Alcohol	
	Ballot Measure	State Legislation	Ballot Measure	State Legislation
Articulated Public Health Goals	8, (57 %)	7, (88 %)	4, (33 %)	3, (38 %)
Data Collaboration with Public Health Agencies	4, (29 %)	4, (50 %)	2, (16.7 %)	1, (13 %)
Agency Public Health Efforts	6, (43 %)	4, (50 %)	3, (25 %)	3, (38 %)
Agency Law Enforcement Efforts	9, (64 %)	5, (63 %)	8, (67 %)	6, (75 %)
	N = 14	N = 8	N = 12	N = 8

in the first waves of adult-use cannabis legalization, were financially and substantively contributed by major advocacy organizations, such as the Marijuana Policy Project and Drug Policy Alliance (Orenstein & Glantz, 2020). These advocacy efforts heavily influenced the content of ballot initiatives and what was eventually passed into law, reflected by the similarities in policy content enacted by early legalizers of adult-use cannabis (Leon & Weitzer, 2014). Additionally, disagreement in policy objectives between legislatures and constituencies on the content of ballot initiatives can result in legalization delivering on few of the promoters' promises. A recent example of this is Ohio, whose state legislators are in the process of rolling back several components of the legalization ballot initiative passed in 2023, including equity licensing programs and the elimination of cannabis-related criminal penalties (Trau, 2025).

In contrast, some cannabis regulators who implemented legalization early on have demonstrated relative success at pursuing public health agendas, indicating a possibility for successful public health reform efforts of extant agencies. For instance, Washington, which legalized adult-use cannabis in 2012, recently released a 5-year plan to transition their cannabis regulatory agency towards a stronger public health orientation (Washington State Liquor & Cannabis Board, 2024). Our findings in no way conclude that state legislation is causally related to good or effective cannabis regulation and policy but do suggest there is some aspect of states that legalize via legislation that warrants further attention.

The role of these state agencies as revenue generators, as evidenced by the common placement of alcohol and cannabis regulators under revenue and licensing departments, may also play a notable role in agencies' perceptions of their obligation to substance-related public health outcomes. Several of the reports only provided analyses of the financial components of the adult-use cannabis and alcohol industry, such as the number of new licenses issued, gross business revenue, and tax receipts. If regulators are explicitly tasked by the state to oversee for-profit licensing and tax collection, then it is reasonable to expect that these agencies would allocate fewer resources to pursuing and reporting public health measures.

As a final caveat to our findings, the placement of alcohol and adult-use cannabis regulators within a particular agency is likely to influence the market activities recorded in reports, which may mean that some priorities held by regulators may not be captured in reports. Regulators may collaborate with or defer reporting to other agencies and organizations that are better suited to monitor and act on cannabis-related public health outcomes, in which case our analysis will understate the prevalence of public health and safety priorities. However, only slightly more than a third (37 %) of cannabis regulators currently report collaborations with their state's public health agency. This is compared to 63 % of cannabis regulators that report law enforcement collaborative data collection and programming efforts. These findings suggests that many regulators and the legislatures that dictate the contents of annual

cannabis reports may view law enforcement as the principal means of achieving cannabis-related health and safety outcomes. However, law enforcement covers a narrow range of the potential consequences of increased cannabis prevalence and predominantly serves as a reactive measure against license violations, as well as those who sell cannabis or alcohol to minors and who drive under the influence. Reductions in the illicit cannabis market and underage consumption, commonly headed by law enforcement, are necessary but insufficient components in the pursuit of cannabis-related public health (Wiens et al., 2018).

Public health departments, based on the reports produced by these agencies, regularly maintain a closer eye on broader public health outcomes that don't involve law violations, such as the prevalence of Cannabis Use Disorder (CUD), demographic trends in cannabis use, and youth consumption (Maryland Department of Health 2024). Given this, there appears to be significant room for future collaboration between cannabis regulators and public health agencies to further data collection efforts and pursue initiatives to monitor and address any consequences of adult-use cannabis legalization.

The reports analyzed in this study provide among the most reliable and consistent publicly available data on agency activities for both adult-use cannabis and alcohol regulators across US states. The findings derived from these documents are indicative of the apparent focal concerns of agencies based on their reported activities. However, it should be emphasized that this analysis is not a comprehensive overview of all US state efforts or the values and concerns that underlie the state's approach to regulating its market.

As such, this study is just the first step in a research agenda for assessing the quality of cannabis regulation with respect to cannabis-related public health outcomes. The next step should be to assess whether the inclusion of these measures in regulators' reports is indicative of more attention to the health consequences of regulatory actions. Considering that report production is an intentional effort of agencies, often at the direction of their respective legislature, it is useful for future work to interrogate whether agencies that track the prevalence of youth consumption of cannabis undertake more actions to reduce that prevalence, for example by supporting primary prevention messages in media and social media or through targeted crackdowns against vendors who fail to effectively monitor the age restriction on customers. An ancillary component of this question also includes whether state legislatures which dictate more comprehensive reports on behalf of adult-use cannabis agencies generate better health outcomes. Further research should also pursue comparative reviews of statutes which govern adult-use cannabis management in other countries that have legalized adult-use cannabis, such as Canada and Uruguay. Comparative research may provide further insights into the goals, activities, and articulated responsibilities of regulators outside of US states' standard for-profit licensing model. Moreover, future work should assess whether the stated goals and actions undertaken by adult-use cannabis regulators are associated with better community health outcomes. However, without evidence that agencies are tracking health outcomes or collaborating with agencies that are, it may be unrealistic to expect that they will be taking policy or administrative actions to improve those specific outcomes.

Conclusion

Our findings contribute to the growing body of literature on the role of cannabis regulators in pursuing public health efforts and the perceived responsibility of these regulators by state legislatures and the agencies themselves to regulate within a public health framework. We reach three primary conclusions from the descriptive analysis of cannabis and alcohol regulators' annual reports. First, US states that have legalized adult-use cannabis through state legislation report efforts to mitigate the potential public health effects of cannabis far more often than early adopters and states that legalize through ballot initiatives. Second, even though regulatory agencies commonly report public health

and safety as an aim, collaborative data collection efforts and initiatives with public health agencies are substantially less common than collaborations with law enforcement. This may be a result of public health agencies pursuing independent efforts or a perceived lack of need for collaboration. Finally, there is more variation in reported public health orientations across states than within states. Agencies whose reports referenced a greater number of public health alcohol indicators were more likely to communicate public health-oriented cannabis regulatory efforts.

Currently, fewer than half of all US states have legalized adult-use cannabis. So long as adult-use cannabis remains criminalized federally, states will retain the principal responsibility in regulating and supervising their adult-use markets. Thus, how legalization is enacted and regulation occurs at the state level remains crucial. Future work which evaluates how public health-related actions reported by cannabis agencies translate into tangible public health benefits among cannabis using and affected population is critically needed.

CRediT authorship contribution statement

Codey J. Carr: Writing – review & editing, Writing – original draft,

Appendix

Appendix A1

State-level characteristics of adult-use cannabis legalization.

State	Year of Cannabis legalization	Method of legalization
Alaska	2014	Ballot measure
Arizona	2020	Ballot measure
California	2016	Ballot measure
Colorado	2012	Ballot measure
Connecticut	2021	Legislation
Delaware	2023	Legislation
Illinois	2020	Legislation
Maine	2016	Ballot measure
Maryland	2022	Ballot measure
Massachusetts	2016	Ballot measure
Michigan	2018	Ballot measure
Minnesota	2023	Legislation
Missouri	2022	Ballot measure
Montana	2020	Ballot measure
Nevada	2016	Ballot measure
New Jersey	2020	Ballot measure
New Mexico	2021	Legislation
New York	2021	Legislation
Ohio	2023	Ballot measure
Oregon	2014	Ballot measure
Rhode Island	2022	Legislation
Vermont	2020	Legislation
Virginia	2021	Legislation
Washington	2012	Ballot measure

Appendix A2

Adult-use cannabis regulatory agencies and report availability.

State	Formal regulatory agency	Office within agency	Report availability
Alaska	Department of Commerce, Community, and Economic Development	Alcohol and Marijuana Control Office	No
Arizona	Department of Health Services	Bureau of Marijuana Licensing	Yes
California	Department of Cannabis Control	Independent Regulatory Body	Yes
Colorado	Department of Public Health and the Environment, Governor's Office of Marijuana Coordination, & Department of Revenue (Joint)	Marijuana Enforcement Division	Yes
Connecticut	Department of Consumer Protection	Drug Control Division	Yes
Delaware	Department of Safety and Homeland Security	Office of the Marijuana Commissioner	Yes

(continued on next page)

Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Peter Reuter:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization. **Greg Midgette:** Writing – review & editing, Supervision, Funding acquisition.

Declaration of competing interest

The authors declare no further conflicts of interest.

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Appendix A2 (continued)

State	Formal regulatory agency	Office within agency	Report availability
Illinois	Illinois Cannabis Regulation Oversight Office	Department of Finance and Professional Regulation	No
Maine	Office of Cannabis Policy	Department of Administrative and Financial Services	Yes
Maryland	Alcohol, Tobacco, and Cannabis Commission	Maryland Cannabis Administration	Yes
Massachusetts	Massachusetts Cannabis Control Commission	Independent Regulatory Body	Yes
Michigan	Michigan Cannabis Regulatory Agency	Department of Licensing and Regulatory Affairs	Yes
Minnesota	Minnesota Office of Cannabis Management	Independent Regulatory Body	Yes
Missouri	Missouri Division of Cannabis Regulation	Department of Health and Senior Services	Yes
Montana	Montana Cannabis Control Division	Department of Revenue	Yes
Nevada	Nevada Cannabis Compliance Board	Independent Regulatory Body	Yes
New Jersey	New Jersey Cannabis Regulatory Commission	Independent Regulatory Body	Yes
New Mexico	New Mexico Cannabis Control Division	Regulation and Licensing Department	Yes
New York	New York Office of Cannabis Management	Independent Regulatory Body	Yes
Ohio	Ohio Division of Cannabis Control	Department of Commerce	Yes
Oregon	Oregon Liquor and Cannabis Commission	Independent Regulatory Body	Yes
Rhode Island	Rhode Island Cannabis Control Commission	Department of Business Regulation	Yes
Vermont	Vermont Cannabis Control Board	Independent Regulatory Body	Yes
Virginia	Virginia Cannabis Control Authority	Independent Regulatory Body	Yes
Washington	Washington State Liquor and Cannabis Board	Independent Regulatory Body	Yes

Appendix A3

Alcohol regulatory agencies and report availability.

State	Formal Regulatory Agency	Office within Agency	Report Availability
Alaska	Alcohol and Marijuana Control Office	Department of Commerce, Community, and Economic Development	No
Arizona	Arizona Department of Liquor Licenses and Control & Arizona State Liquor Board	Independent Regulatory Body	Yes
California	California Department of Alcohol Beverage Control	Independent Regulatory Body	Yes
Colorado	Liquor and Tobacco Enforcement Division	Department of Revenue	Yes
Connecticut	Connecticut Liquor Control Division	Department of Consumer Protection	Yes
Delaware	Delaware Office of the Alcoholic Beverage Commissioner	Department of Safety and Homeland Security	No
Illinois	Illinois Liquor Control Commission	Independent Regulatory Body	Yes
Maine	Maine Bureau of Alcoholic Beverages & Lottery Operations	Department of Administrative and Financial Services	Yes
Maryland	Maryland Alcohol, Tobacco, and Cannabis Commission	Independent Regulatory Body	Yes
Massachusetts	Massachusetts Alcoholic Beverages Control Commission	State Treasury	Yes
Michigan	Michigan Liquor Control Commission	Department of Licensing and Regulatory Affairs	Yes
Minnesota	Minnesota Alcohol and Gambling Enforcement Division	Department of Public Safety	Yes
Missouri	Missouri Division of Alcohol and Tobacco Control	Department of Public Safety	No
Montana	Montana Alcoholic Beverage Control Division	Department of Revenue	Yes
Nevada	NA	NA	No
New Jersey	New Jersey Division of Alcoholic Beverage Control	Department of Law & Public Safety	Yes
New Mexico	New Mexico Alcoholic Beverage Control Division	Regulation and Licensing Department	Yes
New York	New York Division of Alcoholic Beverage Control	New York State Liquor Authority	Yes
Ohio	Ohio Division of Liquor Control	Department of Commerce	Yes
Oregon	Oregon Liquor and Cannabis Commission	Independent Regulatory Body	Yes
Rhode Island	Liquor Enforcement and Compliance Section - Division of Commercial Licensing	Rhode Island Department of Business Regulation	Yes
Vermont	Vermont Division of Liquor Control	Department of Liquor and Lottery	Yes
Virginia	Virginia Alcoholic Beverage Control Authority	Independent Regulatory Body	Yes
Washington	Washington State Liquor and Cannabis Board	Independent Regulatory Body	Yes

Appendix A4

Adult-use cannabis and alcohol agency reports.

State	Cannabis	Alcohol
Arizona	Arizona Marijuana Program. <i>April 2024 Monthly Report</i> . 2024. Arizona Department of Health Services. https://www.azdhs.gov/documents/licensing/medical-marijuana/reports/2024/mm-apr24.pdf	State of Arizona Department of Liquor Licenses and Control. <i>FY2024 Annual Report</i> . 2024. Author. https://azliquor.gov/assets/documents/Annual%20Report/24_annualrpt.pdf
California	Department of Cannabis Control. <i>Department of Cannabis Control Annual Report</i> . 2025. Author. https://cannabis.ca.gov/wp-content/uploads/sites/2/2025/03/DCC-Annual-Report_Fiscal-Year-2023_24.pdf	Department of Alcohol Beverage Control. <i>Departmental Workload Summary</i> . 2024. Author. https://www.abc.ca.gov/wp-content/uploads/2024/08/annual-workload-summary-2023-24.pdf
Colorado	Colorado Department of Revenue. <i>Fiscal Year 2023 2024 Annual Report</i> . 2024. Author. https://cdor.colorado.gov/sites/revenue/files/documents/2024_Annual_Report_DR4000.pdf	Colorado Department of Revenue. <i>Fiscal Year 2023 2024 Annual Report</i> . 2024. Author. https://cdor.colorado.gov/sites/revenue/files/documents/2024_Annual_Report_DR4000.pdf

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Appendix A4 (continued)

State	Cannabis	Alcohol
Connecticut	Connecticut Consumer Protection. <i>Adult-Use Cannabis Licensing Report</i> . 2025. Author. https://portal.ct.gov/cannabis/-/media/cannabis/reports/auc-licensing-report-2025-q1.pdf?rev=af6e556a31814fad8c3f2d662a1f70b&hash=6633294A4CBBAAE9C144743DA9BC4E08	Department of Revenue Services. <i>Comparative Statement of Alcohol Beverage Sales for the Month of October 2022</i> . 2022. Author. https://portal.ct.gov/-/media/drs/research/2022-alcohol-reports/o-255-return-oct22.pdf?rev=af7f5af8e303498f87c68c526236c653&hash=3A25E2CE1F65317612F216ADADABC8AB
Delaware	Office of the Marijuana Commissioner. <i>Annual Report 2024</i> . 2024. Delaware Department of Safety and Homeland Security. https://omc.delaware.gov/about/contentFolder/pdf/Annual%20Reports/2024Annual.pdf?cache=1760108746295	
Maine	Sofis M & Slade MS. <i>Maine Office of Cannabis Policy Cannabis Markets & Associated Outcomes – Survey Findings and Implications</i> . 2022. Advocates for Human Potential, Inc. https://www.maine.gov/dafs/ocp/sites/maine.gov/dafs/ocp/files/inline-files/Maine%20OCP%20AHP%20Report%2006-22_0.pdf	Department of Administrative and Financial Services. <i>Annual Report of the Bureau of Alcoholic Beverages and Lottery Operations</i> . 2022. https://www.maine.gov/dafs/bablo/sites/maine.gov/dafs.bablo/files/inline-files/CY21%20-%20Legislative%20Annual%20Report.pdf
Maryland	Maryland Cannabis Administration. <i>Maryland Cannabis Use Biannual Study</i> . 2025. Maryland Alcohol, Tobacco, and Cannabis Commission. https://dlslibrary.state.md.us/publications/EXEC/MCA/HG13-4401%28c%29_2024.pdf	Alcohol, Tobacco, and Cannabis Commission. <i>2024 Alcohol and Tobacco Tax Annual Report</i> . 2024. Author. https://atcc.maryland.gov/wp-content/uploads/sites/24/2024/12/2024-ATCC-Annual-Report-Final-LoRes.pdf
Massachusetts	Cannabis Control Commission. <i>7th Annual Activities Report</i> . 2024. Author. https://masscannabiscontrol.com/wp-content/uploads/2024/10/CCC-Seventh-Annual-Activities-Report-2024.pdf	Alcoholic Beverages Control Commission. <i>Fiscal Year 2023 Annual Report</i> . 2023. Department of the State Treasurer. https://www.mass.gov/doc/fiscal-year-2023-annual-report/download
Michigan	Cannabis Regulatory Agency. <i>Monthly Report: March 1, 2025 – March 31st, 2025</i> . 2025. Department of Licensing and Regulatory Affairs. https://www.michigan.gov/cra/-/media/Project/Websites/cra/Agency-Reports/Statistical-Reports/monthly-report/March-2025-Monthly-Report.pdf	Liquor Control Commission. <i>2023 Annual Financial Report</i> . 2023. Michigan Department of Licensing and Regulatory Affairs. https://www.michigan.gov/lara/-/media/Project/Websites/lara/lcc/MLCC-Financial-Reports/2023-Annual-Financial-Report-Posted.pdf?rev=393441c8b8d4f36f9f56df0654d95296&hash=00237CFFBD93B082B493D15D507FD051
Minnesota	Office of Cannabis Management. <i>OCM Annual Report to the Legislature (2025)</i> . 2025. Author. https://mn.gov/ocm/assets/OCM_2025_Annual_Report_0115_tcm1202-665240.pdf	Department of Revenue. <i>Summary of Alcohol Sales</i> . 2024. Author. https://www.revenue.state.mn.us/sites/default/files/2025-02/alcohol-sales-summary-report-2024.pdf
Missouri	Missouri Department of Health & Senior Services. <i>Missouri Medical and Adult-Use Cannabis Annual Report</i> . 2024. Author. https://health.mo.gov/safety/cannabis/pdf/2024-medical-and-adult-use-annual-report.pdf	
Montana	Cannabis Control Division. <i>Estimated Cannabis Sales by County</i> . 2025. Montana Department of Revenue. https://revenuefiles.mt.gov/files/Cannabis/Cannabis-Sales-Reports/2025-Estimated-County-Sales-Reports/February-2025-Estimated-County-Sales-Report.pdf	Montana Alcoholic Beverage Control Division. <i>Liquor Enterprise Report of Operations: Fiscal Year 2024</i> . 2024. Department of Revenue. https://revenuefiles.mt.gov/files/ABCD/Alcoholic-Beverage-Control-Publications/Enterprise-Fund-Report-of-Operations/Enterprise-Fund-Report-of-Operations-FY2024.pdf
Nevada	Cannabis Compliance Board. <i>Nevada Cannabis Compliance Board Biennial Report</i> . 2025. Author. https://ccb.nv.gov/wp-content/uploads/2025/02/CCB-Biennial-Report-2025-FINAL.pdf	
New Jersey	New Jersey Cannabis Regulatory Commission. <i>Annual Report on the Medicinal Cannabis Program & Adult-Use Cannabis</i> . 2025. Author. https://www.nj.gov/cannabis/documents/reports/NJCRC_2024_Annual_Report_FINAL.pdf	Division of Alcoholic Beverage Control. <i>Alcohol Beverage Tax Revenue Report Comparative Statement of Revenue</i> . 2025. Author. https://www.nj.gov/treasury/taxation/pdf/other_forms/alcohol/abt-report/2024/2024abt.pdf
New Mexico	New Mexico Regulation & Licensing Department. <i>2025 Strategic Plan & 2024 Annual Report</i> . 2024. Author. https://www.rld.nm.gov/wp-content/uploads/2025/05/NMRLD-2025-StrategicPlan-medres.pdf	New Mexico Regulation & Licensing Department. <i>2025 Strategic Plan & 2024 Annual Report</i> . 2024. Author. https://www.rld.nm.gov/wp-content/uploads/2025/05/NMRLD-2025-StrategicPlan-medres.pdf
New York	Office of Cannabis Management. <i>New York State Office of Cannabis Management Annual Report</i> . 2024. Author. https://cannabis.ny.gov/system/files/documents/2024/12/ocm-annual-report-2024.pdf	New York State Liquor Authority. <i>2022 Annual Report</i> . 2022. Author. https://sla.ny.gov/system/files/documents/2025/09/annual-report-2022-final.pdf
Ohio	Division of Cannabis Control. <i>Program Update: By the Numbers</i> . 2025. Department of Commerce. https://com.ohio.gov/wps/wcm/connect/gov/2db02238-3101-4845-b999-a64ce6f0887c/DCC_Update_By_The_Numbers.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_JQGCH4S04P41206HNUKVF31000-2db02238-3101-4845-b999-a64ce6f0887c-pq78IWX	Department of Taxation. <i>Annual Report Fiscal Year 2023</i> . 2023. Author. https://dam.assets.ohio.gov/image/upload/tax.ohio.gov/communications/publications/annual_reports/2023annualreport.pdf
Oregon	Oregon Liquor and Cannabis Commission. <i>2023 Annual Government to Government Report</i> . 2023. Author. https://www.oregonlegislature.gov/cis/GovToGovReports/Annual%20Report%20(OLCC)%202,023.pdf	Oregon Liquor and Cannabis Commission. <i>2023 Annual Government to Government Report</i> . 2023. Author. https://www.oregonlegislature.gov/cis/GovToGovReports/Annual%20Report%20(OLCC)%202,023.pdf
Rhode Island	Cannabis Control Commission. <i>Study relating to the state of Cultivation of Adult Use and Medical Cannabis</i> . 2024. Author. https://ccc.ri.gov/sites/g/files/xkgbur991/files/2025-05/Cultivation%20License%20Moratorium%20Report.pdf	Division of Taxation. <i>Sales and Taxation of Alcoholic Beverages</i> . 2024. Department of Revenue. https://tax.ri.gov/sites/g/files/xkgbur541/files/2024-05/Sales%20and%20Taxation%20of%20Alcoholic%20Beverages%20-%20Tax%20Administrator%27s%20Report%2004-30-24.pdf
Vermont	Vermont Cannabis Control Board. <i>Report to the General Assembly</i> . 2022. Author. https://ccb.vermont.gov/sites/ccb/files/2022-12/Final%20draft%20-%20VT%20Concentrates%20Report%20-1.pdf , Vermont Department of Health. <i>Vermont Cannabis Data Pages</i> . 2023. Author. https://www.healthvermont.gov/sites/default/files/document/DSU-CannabisDataReport2023.pdf	Vermont Department of Liquor and Lottery. <i>2024 Annual Report</i> . 2025. Author. https://liquorandlottery.vermont.gov/sites/liqllot/files/documents/DLL_FY24AnnualReport.pdf
Virginia	Virginia Cannabis Control Authority. <i>Annual Report for Fiscal Year July 1, 2023 – July 30, 2024</i> . 2024. Author. https://static1.squarespace.com/static/664229cd06b6f9326d1e815c/t/675757978869ce60064c69b1/1733777318343/2024-CCA-Annual-Report.pdf	Virginia Alcoholic Beverage Control Authority. <i>Virginia ABC Comprehensive Financial Report</i> . 2024. Author. https://www.abc.virginia.gov/library/about/pdfs/fy2024-virginiaabc-annualreport-final-web.pdf?rev=ac3c18c707dd49c4f9956e0dba97619&hash=1FE7AD7917F841BDEA264196E6418FCC
Washington	Washington State Liquor and Cannabis Board. <i>Annual Report Fiscal Year 2024</i> . 2024. Author. https://lcb.wa.gov/sites/default/files/publications/2024-annual-report-final-opt.pdf	Washington State Liquor and Cannabis Board. <i>Annual Report Fiscal Year 2024</i> . 2024. Author. https://lcb.wa.gov/sites/default/files/publications/2024-annual-report-final-opt.pdf

Appendix A5

Adult-use cannabis and alcohol agency-reported public health and safety data collection and collaboration efforts.

State	Cannabis			Alcohol		
	Public Health Data	Public Health Effort(s)	Law Enforcement Effort(s)	Public Health Data	Public Health Effort(s)	Law Enforcement Effort(s)
Alaska						
Arizona					Prevention specialists Education programs	License Violation Investigation Division Minor-in-Possession and license compliance statistics program
California			Illicit cannabis seizures and cannabis testing violations statistics			License Violation Investigation Division
Colorado			Reports DUI and underage possession statistics			Reports DUI and underage possession statistics
Connecticut						
Delaware						
Illinois					Underage consumption public awareness campaign	Reports license violations for sale of alcohol to minors statistics
Maine	Reports on past month use, cannabis prevalence, and cannabis use disorder	Contracts with public health agencies and private organizations to collect data on cannabis-related public health outcomes	Reports DUI and underage possession statistics			
Maryland	Reports on past month use, cannabis prevalence, youth perceptions of cannabis use, cannabis-related hospitalizations, and cannabis use patterns	Contracts with public health agencies and private organizations to collect data on cannabis-related public health outcomes				Reports license violations for sale of alcohol to minors statistics
Massachusetts	Houses cannabis research division (data not included in report)	Cannabis use public awareness campaign	License Violation Investigation Division			License Violation Investigation Division Reports license violations for sale of alcohol to minors statistics
Michigan			License Violation Investigation Division	Reports state alcohol consumption statistics		License Violation Investigation Division
Minnesota	Reports changes in cannabis THC potency Data collection efforts with departments of Public Health and Health and Human Service (data not included in report)	Youth cannabis use education programs Pregnancy and breastfeeding education programs	Reports DUI and underage possession statistics Reports collaboration with law enforcement agencies			Housed under public safety department License Violation Investigation Division
Missouri		Substance use disorder grant program	License Violation Investigations			
Montana					Alcohol Use Outreach Unit Education Unit and Programming	License Violation Investigations Reports on license violations
Nevada			Reports collaboration with Department of Public Safety			
New Jersey		Reports revenue reinvestment in cannabis-related public health efforts	Reports DUI, illicit possession, and illicit distribution statistics			
New Mexico			License Violation Investigation Division			Reports collaboration with law enforcement agencies
New York	Reports ongoing data collection collaborations with health and community stakeholders	Cannabis use education campaigns	License Violation Investigation Division			License Violation Investigation Division
Ohio						
Oregon						
Rhode Island						

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Appendix A5 (continued)

State	Cannabis			Alcohol		
	Public Health Data	Public Health Effort(s)	Law Enforcement Effort(s)	Public Health Data	Public Health Effort(s)	Law Enforcement Effort(s)
Vermont	Reports on cannabis use prevalence, cannabis use during pregnancy, and emergency department admissions	Reports collaborations with Department of Health	Reports DUI statistics	Reports providing data for statewide datasets (data not included in report)	Education programming (consumers and businesses)	License Violation Investigation Division
Virginia	Reports on health consequences of high THC potency cannabis	Reports ongoing working groups with Public Health Department	Data collection on safe driving habits		Education and outreach programming	License Violation Investigation Division
Washington	Houses research division (data not included in report)	Education and outreach programming Public health agency and private agency partnerships	License Violation Investigation Division	Houses research division (data not included in report)	Education and outreach programming	License Violation Investigation Division

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