



Annex

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Indiana's Cannabis Landscape

Annex I, Evidence on the Effects of Cannabis
Legalization

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About This Annex

This annex summarizes evidence from a review of studies examining the effects of adult-use cannabis legalization policies on seven categories of policy-relevant outcomes: cannabis use and perceptions of harm, other substance use, health and health care outcomes, traffic crashes and mortality, labor markets and economic well-being, crime and social outcomes, and state budgets. These findings are useful as a stand-alone document but were prepared as supplementary material to inform the findings of our research report, *Indiana's Cannabis Landscape*, which is available at www.rand.org/t/RRA4439-1.

RAND Drug Policy Research Center

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The views presented in the report are those of the authors and should not be interpreted as endorsements by the funders, reviewers, or people with whom we spoke.

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Indiana's Cannabis Landscape: Annex I, Evidence on the Effects of Cannabis Legalization

Introduction and Summary Results

This annex summarizes evidence from our review of high-quality studies examining the effects of adult-use cannabis legalization policies on seven categories of policy-relevant outcomes: cannabis use and perceptions of harm, other substance use, health and health care outcomes, traffic crashes and mortality, labor markets and economic well-being, crime and social outcomes, and state budgets. Our review, which covers studies published between July 2018 and April 2025, extends a recent review of the literature conducted on behalf of the European Union Drugs Agency by many of the authors of this report. We restrict our review to synthesize evidence from studies that evaluate the effects of policies legalizing cannabis supply for use beyond only medical purposes. A discussion of the effects of medical cannabis policies is provided in the “The Impacts of State Medical Cannabis Programs” box, but there are serious limitations drawing generalizable conclusions from this literature given substantial variability in medical cannabis policy design, and the statistical issues this can cause in commonly used quasi-experimental designs (Wing et al., 2024).

To focus on studies most likely to generate accurate estimates of the causal effects of cannabis legalization, our prespecified inclusion criteria restrict to quasi-experimental studies that compare outcomes before and after the implementation of adult-use cannabis laws (ACLs) and policies (e.g., the allowance for or opening of retail stores selling cannabis) and that include a suitable comparison group of jurisdictions without such policies. Within this set of quasi-experimental studies, we prioritize findings from those that provide empirical justification for why their comparison group offers a credible estimate of how outcomes would have evolved in the absence of ACL. We also emphasize findings from studies that estimate policy effects based on the experience of multiple states (more than three) because single-state analyses may not generalize well to future policy contexts, particularly in states that differ economically, politically, and demographically from early adopter states. For topics with an extensive evidence base (e.g., opioid analgesics), we give greater weight to studies evaluating more-recent data, because findings from earlier ACL adoptions during the height of opioid analgesic prescribing and misuse may not generalize to today's context.

A total of 244 quasi-experimental studies were extracted, with the majority of studies evaluating effects on cannabis use or perceptions ($n = 51$), other substance use ($n = 44$), or other health and health care outcomes ($n = 81$), primarily poisonings and substance use disorder. Other notable topics of interest were crime and criminal justice outcomes ($n = 35$), traffic crashes and mortality ($n = 23$), and labor markets or other economic outcomes ($n = 14$). Twenty-four

additional studies evaluated outcomes outside the scope of this review; although we extracted data from these (for more details, see Tables 4 and 5 at the end of this annex), we do not discuss them further.¹

The Impacts of State Medical Cannabis Laws

An extensive amount of literature has evaluated the effects of medical cannabis laws (MCLs) on health, safety, educational, and economic outcomes. Much of this literature assessed the effects of MCL changes that preceded the enactment of ACLs, although recent studies of ACLs often also produced estimates of the effects of MCLs. Typically in these newer studies, MCLs were not a focal policy but regressions models included an indicator of MCL adoption or of medical cannabis dispensary availability to account for potential confounding of MCL policy with ACL policy. Because these studies were mostly designed to estimate the causal effect of ACLs and not the causal effect of MCLs, their findings for MCLs should be taken cautiously.

According to the results of systematic reviews and a targeted review of studies identified through our review, the literature on the effects of MCLs shows a few (relatively) consistent findings. First, the passage of MCLs alone does not appear to increase cannabis use prevalence among youths but does increase cannabis use prevalence and/or frequency among adults (Smart and Pacula, 2019; Anderson and Rees, 2023; Pawar et al., 2024; Sarvet et al., 2018). The opening and expansion of retail markets for medical cannabis, however, may be associated with higher cannabis use rates among *both* adolescents and adults. Effect sizes vary depending on how policies are operationalized and the timeframe studied, but magnitudes are typically on the order of a 5 percent to 10 percent increase in past-month cannabis use (e.g., see Hollingsworth, Wing, and Bradford, 2022), with smaller effect sizes for adolescents compared with adults.

Other relatively consistent findings for the effects of MCLs include statistically significant declines in declines in prescription opioid use and alcohol use among adults, although the magnitude and precision of estimated policy effects vary substantially across studies. Furthermore, when trying to generalize the likely effects of MCLs on use of non-cannabis substances, context matters. Reductions in opioid-related harms may be less expected given the harms from opioid use are now driven primarily by illicit synthetic opioids rather than prescribed opioid analgesics. Benefits in the reduced drinking among some populations may be offset by increased simultaneous use of alcohol and cannabis use among others (Pacula et al., 2022).

Finally, there is little evidence indicating that MCL adoption would significantly increase crime or harm productivity, academic achievement, or labor market outcomes. Despite significant increases in cannabis offense arrests (McCarthy et al., 2025), the effects of MCLs on broader crime and criminal justice outcomes are typically statistically insignificant, with substantial uncertainty such that one cannot rule out relatively large increases or decreases. Findings for labor market outcomes also tend to be statistically insignificant, although a few studies show significant improvements in the labor supply of older adults (Nicholas and Maclean, 2019), reduced absenteeism (Ullman, 2017), and fewer workers' compensation (WC) claims (Ghimire and Maclean, 2020). That said, other studies have found suggestive evidence of declining wages among young men, as well as possible negative effects on academic outcomes (French et al., 2022). It may be that some short-term benefits for economic outcomes are offset by more delayed negative consequences for adolescent academic achievement, but the evidence here is generally weak and inconclusive.

An overarching challenge with drawing strong conclusions from the literature on the effects of MCLs is that MCLs are remarkably heterogeneous. State laws have ranged from policies that are heavily medicalized (e.g., requiring that dispensary directors be a licensed physician or pharmacist) or restrictive in terms of product availability and qualifying conditions to policies that allow widespread retail availability and accept a broad variety of conditions that qualify for medical cannabis use (Richard et al., 2021). The costs and benefits of enacting an MCL—which appear to be a function more of changes in social and physical availability rather than social approval or legal risks—will depend critically on the restrictiveness or permissiveness of the chosen policy.

¹ Other outcomes examined in these studies include but are not limited to medical cannabis registration rates, food consumption, obesity, and Bitcoin markets (see Table 5).

To draw conclusions about policy effects, we prioritized higher-quality quasi-experimental studies, but we incorporated additional more descriptive evidence when higher quality causal evidence was not available. Specifically, for outcomes with inconclusive or limited evidence from quasi-experimental studies, we supplemented results from our systematic search with a targeted search of the literature for descriptive or observational evidence that, while not providing evidence for the causal effects of cannabis policy change, might still be useful for policy decisions.

Drawing across both quasi-experimental and descriptive results, in Table 1, we summarize the strength of evidence in terms of the direction of effect of adult-use cannabis policies on outcomes within each category. The strength and consistency of evidence vary considerably across categories and specific outcomes therein. For example, the evidence base is generally stronger for adult outcomes than youth outcomes, and effects often vary by the stage of policy implementation assessed (e.g., legalization of use and possession versus the opening of retail stores selling cannabis) or by demographic groups. For certain categories, specifically those italicized in Table 1, the evidence base is sparse because there are few recent high-quality quasi-experimental studies that use appropriate control groups and address potential confounders.

For outcomes in which numerous studies exist, such as traffic crashes and opioid-related mortality, the heterogeneity in findings precludes definitive conclusions. This heterogeneity arose from multiple sources: differences in study location (ranging from single municipalities to national analyses), observation periods (from immediate post-legalization to multiyear follow-ups), data sources (administrative records versus survey data), policy definitions (legalization enactment versus retail sales implementation), and analytical approaches (e.g., difference-in-differences [DID], synthetic controls, interrupted time series). Additionally, studies varied in their treatment of concurrent policy changes, particularly MCLs, opioid prescribing reforms, and other substance use policies that may have confounded the estimated effects of legalization. The timing of studies related to policy implementation also mattered because several analyses suggest that effects evolve over time—with some immediate changes on some outcomes dissipating with time, while others emerged only after retail markets had matured. For each outcome category in which findings conflict or methodological limitations persist, we characterize the evidence as mixed, inconclusive, or insufficient to support causal claims about the impact of recreational cannabis legalization.

Some evidence appears to conflict, notably decreased treatment admissions for cannabis use disorder (CUD) in the face of increasing cannabis use and poisonings. This finding may reflect the elimination of court-mandated treatment after decriminalization and legalization of possession, changes in perceived treatment need as use becomes normalized, and shifts toward self-management rather than formal treatment-seeking. Further research is needed into these specific mechanisms.

Table 1. Summary of Evidence on the Effects of Adult-Use Cannabis Legalization, by Outcome

Outcomes of Focus	Findings Generally Point to...
Cannabis Use and Perceptions	
Cannabis prevalence among adults	Increases in past-month use; larger effects after retail opening
Cannabis prevalence among youth/young adults	Mixed; modest increases among young adults, null to small increases among youth
Cannabis initiation	Increases among adults; larger effects with retail access
Perceptions of cannabis harms	Decreases in perceived risk among youth
<i>Modes of consumption</i>	<i>Limited causal evidence; sales data show shifts toward concentrates and edibles</i>
Use of Other Substances	
Opioid analgesic prescribing	Modest reductions that may have attenuated over time; effects may be smaller in settings with lower rates of inappropriate prescribing or misuse
Tobacco use	Increases in cannabis-tobacco co-use but no increase in tobacco or nicotine use overall
Alcohol use	Small increases in consumption; increases in alcohol-cannabis co-use among adults
Other substance use or distribution	Mixed; some limited evidence of benzodiazepine prescribing reductions
Substance Use Disorders and Poisonings	
CUD	Stable or declining treatment admissions despite increased use prevalence
Cannabis-related poisonings	Increases, especially after commercialization and edible legalization
Cannabis-related emergency department and hospital visits	Increases in cannabis-related encounters
Opioid overdose mortality	Mixed and inconclusive, with more recent studies indicating potential harms; insufficient evidence for causal claims
Other substance disorders and adverse outcomes	Insufficient evidence for causal claims
Other Health Outcomes	
Mental health	Mixed and inconclusive; heterogeneous effects across populations
Suicide and suicidality	Mixed; some evidence of increases among youth in early-adoption states
<i>Pain</i>	<i>Limited causal evidence for policy effects; but randomized controlled trials of cannabinoids indicate possible small benefits for improving pain severity</i>
Traffic Crashes and Mortality	
	No consistent effect from legalization alone; overall increases after retail stores open; appear to be driven by a subgroup of states
Labor Market and Other Economic Outcomes	
Labor markets and income support	Small or null overall effects; agriculture employment increases

Outcomes of Focus	Findings Generally Point to...
Tourism	Increases in early adopting states; likely attenuated for later adopters
<i>Home prices</i>	<i>Limited causal evidence; studies show mixed local effects depending on jurisdiction and study design</i>
Social Outcomes	
Population change	Small positive effects in early adoption states; may not generalize to late adopter states
Crime and arrests	Large decreases in cannabis possession arrests; null effects on violent and property crime
<i>Homelessness</i>	<i>Limited peer-reviewed evidence</i>
State Budgets	<i>Limited causal evidence; significant cannabis tax revenues, but magnitude varies by state; offset considerations apply</i>

NOTE: Italicized categories do not have sufficient peer-reviewed quasi-experimental evidence to establish causal relationships; descriptive or observational findings are summarized for these outcomes.

After further describing the methods of the review, the following sections provide a more detailed discussion of the studies that informed the summary conclusions in Table 1. For each outcome domain, we first briefly describe the policy relevance and theoretical mechanisms. We then summarize findings from the quasi-experimental literature, prioritizing results from methodologically stronger studies. We then narratively discuss specific stronger quasi-experimental studies, describing the research designs and magnitudes of estimated policy effects. Because the specific outcome measures often varied across studies, and the data used across studies were not independent (i.e., many studies were evaluating the same data source), it was not possible to aggregate studies' point estimates meta-analytically. For outcomes without consistent results from strong quasi-experimental studies, we supplement our discussion by providing evidence from relevant descriptive or observational research.

Methods

We conducted a rapid evidence assessment to examine the impact of adult-use recreational cannabis legalization policies on any outcome between July 2018 and April 2025. Rapid evidence assessments are similar to systematic reviews in that they are rigorous, systematic, and comprehensive, but they differ in that they are accelerated by streamlining certain processes and tailoring the searches post-hoc to make the scope manageable. This type of review is particularly suited to rapidly changing policy environments, such as cannabis legalization (Moons, Goossens, and Thompson, 2021). For this review, the term *adult-use cannabis legalization policies* included policy changes relating to adult-use cannabis, for example, the effective date of legalization (hereafter *adult-use legalization* in this annex), the date when consumers can purchase legal cannabis (hereafter *retail market opening* in this annex), or the legalization of cannabis products in different stages. For instance, in Canada, some researchers separate adult-use legalization into two phases (Phase 1 and Phase 2). Phase 1 was the date that the law became effective and dried flower was legally available to purchase. Phase 2 was the date that edibles, extracts and topicals became legally available to purchase and, depending on which province, coincided with an expansion of retail stores. In Uruguay, there were three stages of legalization: the effective date of legalization, the date when consumers were permitted to cultivate cannabis at home or join a cannabis social club, and the date when consumers could purchase cannabis from pharmacies.

Search Strategy

To conduct our search, we used five academic databases and three gray literature sources to extract the relevant literature on the impacts of adult-use cannabis legalization policies (Criminal Justice Abstracts [EBSCOhost]; Econlit [EBSCOhost]; PubMed [NIH/NLM]; Web of Science [Clarivate]; Scopus [Elsevier]; ISSDP gray literature bibliography; Google Scholar [first 300 hits]; Google Advanced Search [first 300 hits]). Our search terms were broad in nature to capture all studies that examine the impact of adult-use cannabis legalization policies in the Americas on any outcome. We included terms relating to

- the substance of interest: cannabis OR marijuana
- the regulatory frameworks of interest: legal* OR regulat* OR reform* laws OR law OR "recreational marijuana legali*" OR "Public Policy" OR "Drug Legislation"
- the countries of interest, which were those that had legalized supply of cannabis for adult use: United States, Canada, or Uruguay.

Three searches were conducted. The first search was conducted on May 9, 2023; the second on October 23, 2023; and the third on April, 11 2025. We used EndNote and Covidence to create a library of resources identified for the review and keep track of the number of results returned.

Screening and Study Selection

After de-duplication, we screened the title and abstracts according to the following inclusion criteria:

- language: English and Spanish
- time frame: Studies published between July 2018 to April 2025
- countries of interest: United States, Canada, and Uruguay
- substantive scope: Studies examining any effect of adult-use cannabis legalization
- sources: peer-reviewed journal articles, gray literature, and government reports
- studies: quantitative empirical studies.

For the first search, three members of our research team initially screened the same 50 randomly selected studies. These three researchers then met and discussed the decisionmaking processes of their screening to ensure collective understanding of the inclusion criteria. After agreement, two researchers completed the title and abstract screening. In the second search, two researchers completed the title and abstract screening, and one researcher completed the title and abstract screening in the third search. The same researchers were used throughout the study for consistency. For any study in which the researchers were uncertain whether to include or exclude, another team member (who did not conduct the initial screening) reviewed these studies, discussed with the screening researchers, and made the final decision.

At the full-text review stage for all searches, one researcher screened all the results, and a second researcher reviewed a sample of randomly selected studies to confirm agreement.

Our research team found 602 studies that met our title and abstract screening inclusion criteria. We added further inclusion criteria at the full-text review stage with the intention of including only the highest quality evidence. We refined our final number of studies by restricting to

- studies that used a quasi-experimental design with a control group (e.g., difference-in-differences [DID] methods) or an interrupted time series analysis (ITSA) where the pre-period was the control group
- studies that included pre- and post-time periods
- studies that used representative samples or were weighted to become representative.

Following this refinement, 244 studies remained. Bibliographic information and further details on these 244 studies are provided in the additional tables included at the end of this annex (Tables 4 to 6).

Extraction

For each of the 244 studies that met our final inclusion criteria described above, a single reviewer extracted information, which was then checked by a second reviewer. Extracted information included: study metadata (e.g., author, year of publication, title), study setting (e.g.,

location, population evaluated, time period studied), analytic characteristics (e.g., geographic and temporal units of analyses, number of observations), study design (e.g., empirical strategy, “treated” and “control” conditions, regression model specification), data sources, results (e.g., coefficient estimate, standard errors), and authors’ summary of findings.

Evidence Synthesis and Targeted Searches

Despite the further refinement of studies according to their study design, a wide variability in quality remained. Therefore, our presentation of findings reflects conclusions drawn from studies that the researchers deemed to be the highest quality. For instance, studies of higher quality tended to be those that used more-rigorous statistical methodologies (e.g., DID) with robustness checks and tests of identifying assumptions, had more than one treated unit, had an appropriate counterfactual, and included multiple years of data after the policy change.

Using our team’s prior efforts reviewing the evidence for the effects of cannabis policy, we anticipated that the quasi-experimental literature would be weak or nonexistent for several important outcomes (e.g., social outcomes other than crime, labor market performance, modes of consumption). For these outcomes, we conducted supplemental targeted searches with an expanded inclusion criteria to identify studies or reports that may be more descriptive or strictly correlational in nature. Throughout our evidence syntheses, which are organized by outcome category, we clearly state those results or analyses that came from this additional targeted search.

Detailed Results

A total of 244 quasi-experimental studies were extracted and used to inform our findings. We did not restrict our review to the U.S. context, since evidence of the effects of ACL adoption in other countries that have chosen less-commercial models of regulation is informative about more restrictive approaches to cannabis regulation, but most of the studies used data from the United States ($n = 189$); the rest used data from Canada ($n = 45$), Uruguay ($n = 5$), or both Canada and the United States ($n = 5$). Table 2 summarizes the outcomes assessed across the 244 studies we reviewed, tabulating study counts by the country studied. Despite the wealth of evidence on the impact of adult-use cannabis legalization policies, the number of studies varied considerably by category. For outcomes with inconclusive or limited evidence from quasi-experimental studies, we supplemented results from our systematic search with a targeted search of the literature for descriptive or observational evidence that, while not providing evidence for the causal effects of cannabis policy change, might still be useful for policy decisions.

Table 2. Count of Quasi-Experimental Studies Analyzed by Outcome Category and Country

Category	Total Studies	National Context Studied			
		U.S.	Canada	U.S. and Canada	Uruguay
Cannabis use and perceptions	51	41	4	4	2
Other substance use	44	40	3	1	0
Other health outcomes	81	57	23	0	1
Traffic crashes and mortality	23	17	4	0	2
Labor markets and economic well-being	14	13	1	0	0
Crime and social outcomes	37	33	3	0	1
State tax revenues	0	0	0	0	0
Other outcomes not classified above	24	18	6	0	0

NOTE: Some studies covered multiple outcomes and so the columns will not sum to the total number of studies.

Cannabis Use and Perceptions

Understanding how cannabis legalization affects cannabis use patterns is fundamental to assessing the broader public health and social implications of policy reform. Increased cannabis use among adults is an expected consequence of legalization—and one that some proponents of ACL view positively if it reflects adults making informed choices about their own consumption. The greater concerns are increases in use among youth, increases in heavy or problematic use, or changes in consumption patterns that elevate health risks. This section examines the evidence on how ACLs have affected cannabis use prevalence, initiation, perceptions of harm, and modes of consumption across different age groups.

Summary of Effects on Cannabis Use

The evidence consistently indicates that adult-use legalization increases cannabis use among adults, with effects typically larger following the opening of retail markets than after legalization alone. Studies generally find statistically significant increases in past-month cannabis use of 15 percent to 58 percent among adults ages 26 and older, with effect sizes varying by the specific policy change studied, time since implementation, and model specification.

Effects on youth and young adults are more mixed: several rigorous studies have found no statistically significant changes in youth prevalence after legalization, while others document modest increases—particularly after retail market opening. Young adults (ages 18 to 25 years) generally show larger increases than youth (ages 12 to 17 years), although still smaller than the effects observed among adults 26 and older.

Cannabis initiation has increased among adults, with the largest effects observed after retail cannabis markets open. Generally, increases in cannabis use and initiation grow over the first few years following ACL adoption, consistent with consumption responding to increased availability and lower prices as retail markets expand. Finally, perceptions of cannabis-related harm have declined among youth in legalizing states. This may presage future increases in use if lower perceived risk leads to greater experimentation, again emphasizing the importance of distinguishing between short-term versus longer-term effects.

Evidence from Quasi-Experimental Studies

Cannabis Prevalence

Adults

Of the studies that met our inclusion criteria and examined the impact of adult-use cannabis legalization policies on adult past-year or past-month cannabis use, we focus on ten U.S. studies that were the strongest methodologically. All ten studies estimated policy effects based on multiple jurisdictions, used data that spanned five to 19 years, and incorporated robustness checks. All found statistically significant increases in past-year and past-month cannabis use among adults following adult-use legalization, with or without retail markets.

Although these studies varied in their time frame, the jurisdictions included, methodologies, sensitivity analyses, control groups, and policy change, all relied on the National Survey on Drug Use and Health (NSDUH) dataset. The reliance on NSDUH data potentially explains the similarity of the findings but also introduces an important limitation: Public-use NSDUH data do not provide age information with enough granularity to distinguish the effects of legalization at 21 years of age relative to 20 years. This means most analyses define the term *adult* as either 18 years or older (so including respondents ages 18 to 20 years who are too young to participate in the market legally) or as 26 years or older (which excludes adults of legal ages 21 to 25 years).

Among U.S. studies examining past-year cannabis use among adults, estimated increases ranged between 6 percent to 38 percent, depending on the adult-use cannabis policy change, age,

or the time period examined (Abouk et al., 2023; Ali et al., 2023; Hollingsworth et al., 2022; Marinello, 2025). For example, Ali et al. (2023) used restricted-use NSDUH data between 2004 and 2020 and found statistically significant increases in past-year use among adults ages 19 and older after adult-use legalization and retail market opening, with a stronger effect after retail market opening. Adult-use legalization was associated with a 6.4 percent increase relative to the mean, and the presence of adult-use retail sales was associated with a 37.6 percent increase. Marinello (2025) used a similar time frame with NSDUH data (2002 and 2019) but focused only on the five U.S. states that had implemented adult-use retail markets before 2018. These authors found no statistically significant association between adult-use retail markets and past-year cannabis use among adults 26 and older in the first two years of retail market opening. However, two to four years after retail markets opened, past-year use increased significantly by 5 percentage points, a 32.8 percent increase relative to baseline.

Among the U.S. studies that examined past-month cannabis use among adults, estimated increases ranged 1.4 to 4.1 percentage points, corresponding to relative increases of between 15 percent to 58 percent. As with past-year use, effect sizes varied by period evaluated, model specification, age range of the analyzed population, and adult-use cannabis policy changes assessed. For example, Abouk et al. (2021) used NSDUH data between 2010 and 2018 and found a statistically significant 1.9 percentage point increase in past-month cannabis use among adults ages 26 and older after adult-use legalization (this corresponds to a 17.9 percent increase in use compared with the counterfactual). Dave et al. (2023) used NSDUH data over a longer period (between 2002 and 2019) and found adult-use legalization was associated with a 4.1 percentage point increase in past-month cannabis use, with effect sizes increasing in magnitude with time since legalization.

Youth and Young Adults

Out of the studies that met our inclusion criteria and examined the impact of adult-use cannabis legalization policies on youth or young adult cannabis use, we focus on 11 studies that past-year or past-month cannabis use among youth or young adults and were the strongest methodologically. Overall, findings from this literature are more mixed than those for older adults, with studies estimating significant increases, significant decreases, or no statistically significant changes in use. However, studies focusing on the United States generally point toward an increase in use prevalence among young adults, albeit smaller than that among adults.

Three U.S. studies found statistically significant increases in past-month or past-year youth cannabis use, with effects smaller than those observed for adults and with increases primarily occurring after retail markets opened (Hollingsworth et al., 2022; Marinello, 2025; Wu et al., 2024). Hollingsworth et al. (2022) used data between 2012 and 2017 and found the availability of retail stores led to an increase in past-month use of 14.6 percent and an increase in past-year use of 10.1 percent among youth ages 12 to 17 years. Marinello et al. (2025), using NSDUH over a longer period (2002 to 2019) but focusing on the five U.S. states that implemented adult-use

retail markets before 2018, found a statistically significant increase in past year cannabis use among youth ages 12 to 17 after adult-use retail markets of 1.6 percentage points in the first two years of retail market opening and a 1.9 percentage point increase two to four years after retail market opening. Looking at Washington state specifically, Wu et al. (2024) found a statistically significant increase of 1.6 percent in youth past-month cannabis use after both adult-use legalization and retail market opening.

In contrast, four U.S. studies found no statistically significant increase in past-month cannabis use among youth following adult-use cannabis policy changes. Three of these studies used the Youth Risk Behavior Survey (YRBS), a school-based survey of youth in 9th to 12th grade. Anderson et al. (2019) used YRBS data between 1993 and 2017 and demonstrated a statistically significant 8 percent decrease in the odds of youth past-month cannabis use. Anderson et al. (2021, 2024) revised these analyses by separating the national and state-level YRBS data and adding additional years (1993 to 2019 and 1993 to 2021, respectively). Contrary to Anderson et al. (2019), these later studies did not find a statistically significant change in youth past month use after adult-use cannabis legalization. One other study using NSDUH data (Cerdá et al., 2020) found no statistically significant association between adult-use cannabis policy change and past-month cannabis use.

Evidence for young adults ages 18 to 25 years more consistently points toward increased use following the opening of retail cannabis markets, although some studies found null results (e.g., Cerdá et al., 2020). Three U.S. studies using NSDUH data, demonstrated a statistically significant increase in past-year or past-month cannabis use among young adults ages 18 to 25 after adult-use legalization or retail market opening (Dave et al., 2023; Hollingsworth et al., 2022; Marinello, 2025). Marinello (2025) used NSDUH data between 2002 and 2019 and focused only on the five U.S. states that had implemented adult-use retail markets pre-2018. These authors found that there was no statistically significant association between adult-use legalization and past year cannabis use in the first two years of retail market opening but a statistically significant increase of 6.3 percentage points two to four years after retail market opened (a 1.9 percentage point increase among youth). Dave et al. (2023) used NSDUH data between 2002 and 2019 and found adult-use legalization was associated with a 4.5 percentage point statistically significant increase in past-month cannabis use. The percentage point increased with the number of years after legalization (i.e., a range of 2.5 to 4.7 percentage points between one year post legalization to three or more years post legalization).

Outside the United States, two studies examined youth and young adult cannabis use in Uruguay compared with Chile using data from the National Drug Observatories (Laqueur et al., 2020; Rivera-Aguirre et al., 2022). Laqueur et al. (2020) did not find a statistically significant changes in the prevalence of use among Uruguayan youth use following national legalization policy changes in 2014 or 2015. Using DID methods, Rivera-Aguirre et al. (2022) found that national legalization in 2014 was associated with statistically significant decreases in both past-

month and past-year cannabis use among adolescents ages 12 to 17 years and adults ages 18 to 21 years.

Cannabis Initiation

The studies that met our inclusion criteria and examined the impact of adult-use legalization policies on the initiation of cannabis use all examined multiple jurisdictions with multiple time points pre- and post-policy change, used DID methods, conducted robustness checks, and accounted for the staggered adoption of adult-use legalization and/or retail market opening.

All studies found statistically significant increases in cannabis initiation following adult-use legalization. Most demonstrated a greater increase after cannabis retail markets opened. Estimated percentage point increases ranged between 0.1 and 2.8 depending on age group and cannabis policy. For example, Marinello (2025) used data from 2002 to 2019 to examine the effects of adult-use retail market openings on cannabis initiation among adolescents (ages 12 to 17 years), young adults (ages 18 to 25 years) and adults (26 years and older). They separated the post-policy time periods into those that had operational retail markets for less than two years and those that had more mature retail markets. In the emerging market period, there was a statistically significant increase in cannabis initiation among adolescents of 0.7 percentage point increase. In the later period, there was a statistically significant increase in cannabis initiation among young adults and adults of 2.8 percentage and 0.3 percentage points, respectively. Note that all but one study used NSDUH data, which could explain the homogeneity in their findings. The one study that did not use NSDUH used the Population Assessment of Tobacco and Health (PATH) longitudinal data between 2013 and 2019 and found that adult-use legalization was associated with an increase of 1.3 percentage points in cannabis initiation among nonusers ages 18 and older; effects were larger when the state had a retail market operating (2.5 percentage points versus 0.9 percentage points without a retail market) (Dave et al., 2023).

Perceived Risks of Cannabis Use

We identified seven quasi-experimental studies that met our inclusion criteria and examined the relationship between adult-use cannabis legalization and perceptions of cannabis-related harm or risk. Most of the more-rigorous studies found that legalization was associated with lower perceptions of risk among youth and young adults, consistent with the hypothesis that policy change signals societal acceptance and normalizes cannabis use, although findings varied across age groups, data sources, and jurisdictions studied (Mennis, McKeon, and Stahler, 2023). Other quasi-experimental studies published before and after our systematic search period also found statistically significant declines in perceived harmfulness or risk of cannabis use among youth following adult-use legalization in U.S. states (Cerdá et al., 2017) and following national legalization of edibles and extracts in Canada (Mital and Nguyen, 2025).

Descriptive evidence indicates that eroding perceptions of risk extend beyond only states that have changed cannabis policy. Using NSDUH and Monitoring the Future data to look at general

trends over time in the United States, Carliner et al. (2017) and Sarvet et al. (2018) found significant decreases in perceived harm of occasional cannabis use among adolescents in the decades preceding adult-use legalization. Examining trends in Canada, Winfield-Ward and Hammond (2024) found perceived social approval was stable over time while comfort using cannabis increased over slightly time. Together, these findings suggest that policy signals about the legality of cannabis (not only actual policy changes) may shape social norms and risk perceptions in ways that could influence future use trajectories, particularly among youth.

Evidence from Other Studies

The peer-reviewed quasi-experimental literature examining how adult-use cannabis regulations affect modes of consumption or types of cannabis products used remains limited, in part because largescale data sources have historically collected little detail on consumption patterns. Consequently, most evidence comes from descriptive or observational studies rather than study designs capable of establishing causal relationships.

Descriptive analyses of sales data and survey responses in legal states document substantial changes in the cannabis product landscape. In Colorado, Oregon, and Washington, cannabis concentrates (including vaporizer cartridges and dabs) have grown from a negligible market share at the time of legalization to between 20 percent and 40 percent of sales by weight-equivalent delta-9 tetrahydrocannabinol (THC) in mature markets (Caulkins et al., 2018; Headset, 2025a, 2025b, 2025c). Sales of edibles and other infused products have similarly expanded. Survey data from legal states suggest shifts in how consumers use cannabis, with increases in vaping and edible consumption reported alongside continued flower use (Goodman et al., 2020).

These product shifts have potential public health implications. Higher-potency concentrates may be associated with greater risk of CUD and adverse mental health outcomes, but the evidence base is still developing. Edibles present distinct risks related to delayed onset of psychoactive effects and difficulty with dose titration that have contributed to increases in poisoning-related emergency department visits. However, without rigorous quasi-experimental studies comparing product use patterns between ACL and non-ACL states over time, it remains unclear whether these trends are causally attributable to legalization or reflect broader changes in cannabis markets and consumer preferences.

Other Substance Use

Cannabis legalization may influence the use of substances other than cannabis through several mechanisms, including pharmacological effects, price effects, and shifts in markets or social contexts. If cannabis acts as a substitute for other substances, increased use following legalization could reduce consumption of alcohol, tobacco, or opioids; if it serves as a complement, use of these substances could increase.² Budget constraints also matter: Changes in the relative prices of cannabis vis a vis other intoxicants could change how individuals allocate spending across these goods. Additionally, ACLs may change how individuals access cannabis and where they use it. This can affect access or exposure to other types of substances (e.g., if consumers leave the illegal market, it may reduce their exposure to other illicit drugs; if consumers cannot use cannabis at bars, this may affect their drinking).

Specific aspects of ACLs may further shape these relationships. For instance, effects on tobacco and electronic nicotine delivery system use may depend on how ACLs affect the availability of combustible or vaporized cannabis products. Rules that disallow establishments from selling cannabis alongside tobacco or alcohol, or that restrict the colocation of dispensaries with other retail outlets, may influence use of other legal intoxicants. Another consideration that relates to opioid use and prescribing is the extent to which ACLs have been preceded by broad, narrow, or nonexistent medical cannabis regime.

Summary of Effects on Other Substance Use

Existing research largely supports that the implementation of adult-use cannabis legalization leads to decreases in opioid analgesic prescriptions, although these effects appear to have attenuated in recent years. This attenuation may reflect a broader national shift toward lower rates of opioid analgesic prescribing and use.

Evidence points to possible small increases in alcohol use based on self-reported drinking measures, although studies using alcohol sales or tax receipt data do not show consistent associations. Adult-use legalization does not appear to increase tobacco use and, if anything, appears to reinforce pre-existing decreases in tobacco or nicotine product use prevalence. At the same time, ACLs may lead to increased tobacco and cannabis co-use among adults.

Results for effects on other illegal substances (e.g., illegal opioids or stimulants) and among youth are inconclusive, likely because of issues with statistical power, measurement challenges, and substantive changes in illegal opioid markets that coincided with many recent changes in cannabis policy.

² For example, if cannabis can replace the pain-relieving effects of opioids, increased cannabis use may reduce opioid use; on the other hand, if cannabis and opioids work synergistically, increased cannabis use may increase opioid use.

Evidence from Quasi-Experimental Studies

Alcohol

Out of the studies that examined the relationship between ACLs or cannabis dispensaries and alcohol use or sales, two methodologically rigorous studies conducted among adults (Ali et al., 2022; Macha, Abouk, and Drake, 2022) found small but statistically significant increases in alcohol use after ACL adoption or retail openings, while another reported positive but statistically insignificant effects on binge drinking (Sabia et al., 2024). These studies used DID-style models and accounted for the heterogeneity of cannabis policy effects; however, they analyzed different datasets and measured alcohol use differently. Taken together, estimates were generally consistent with ACLs increasing alcohol consumption (and potentially heavy consumption) among adults, although the estimated effects were small and did not always achieve conventional levels of statistical significance. For example, for past-month drinking, 95 percent confidence intervals (CIs) across studies largely rule out effect sizes exceeding a 4 percent decrease or increase. For binge drinking, heavy drinking, and frequent alcohol use, the 95 percent CIs span from roughly 4 percent reductions to 13 percent increases. One additional study (De and Sun, 2025) found significant decreases in drinking and (short-term) decreases in binge drinking after retail dispensaries opened, although their tests of identifying assumptions suggested that declines in any drinking may have preceded ACL passage.

Five additional studies (Coley et al., 2021; Goncalves et al., 2023a; Hollingsworth et al., 2022; Kim et al., 2021; Wilds and Riddell, 2023), which were subject to greater risk of bias because of confounding, found uncertain effects or statistically significant increases in self-reported alcohol use measures (e.g., binge drinking, simultaneous use of alcohol and cannabis) among some age groups. Four studies using alcohol sales or tax receipt data did not find a consistent association between adult-use legalization and alcohol sales (Calvert and Erickson, 2021; Chamlin, 2020; Miller and Seo, 2021; Veligati et al., 2020).

Evidence for adolescents and college-aged students is mixed, showing uncertain effects (Alley et al., 2020; Coley et al., 2021; Hollingsworth et al., 2022; Kerr et al., 2023; O'Hara et al., 2023) or significant reductions in alcohol use that are often sensitive to the inclusion of certain years or the specification of policy variables (Coley et al., 2024; Goncalves et al., 2023b; Kerr et al., 2018; Reed, Kerr, and Synder, 2024). Given these methodological concerns with these studies and their inconclusive findings, there are limited insights on how ACLs are likely to shape alcohol use among youth.

Tobacco and Nicotine Products

The studies that met our inclusion criteria assessed how ACLs affect the use or sales of cigarettes, other tobacco products, or electronic nicotine delivery systems. The included studies of adult populations generally found reductions or statistically insignificant effects on tobacco use. Hollingsworth et al. (2022) and Dave et al. (2023) found that ACL adoption was associated

with lower prevalence of past-month tobacco or cigarette use. Effects, which were on the order of a 1 to 3 percentage point reduction overall, appeared to emerge a few years after legalization, suggesting that tobacco use changes as cannabis markets expand. Other analyses using individual-level longitudinal data similarly found negative or statistically insignificant effects of ACLs on various measures of nicotine use (Dave et al., 2023; Pravosud et al., 2024; Vuolo et al., 2022).

Using detailed individual-level panel data on tobacco, cannabis, and nicotine product use, Dave et al. (2023) found that ACL adoption significantly increased past-month co-use of tobacco and cannabis among adults. Additional analyses showed that these effects were driven by cannabis use initiation among tobacco users rather than tobacco initiation among cannabis users. These results were broadly consistent with those of Weinberger et al. (2022), who did not carefully test identifying assumptions but evaluated a longer time frame (2004 to 2017 compared with 2015 to 2019 in Dave et al., 2023) using state-representative data.

Studies using tobacco sales or tax receipt data also found negative, although often imprecise, effects of ACL adoption (De and Sun, 2025; Miller and Seo, 2021; Veligati et al., 2021). A key consideration with all of these studies is that the timing of early ACL adoption in U.S. states coincided with largescale reductions in tobacco use prevalence, increases in cigarette taxes, expansions in smoke-free laws, and the rapid emergence and acceptance of novel nicotine delivery devices. If these trends are correlated with variations in cannabis policy, and not adjusted for in analyses, these will confound estimated ACL effects. Several studies documented that differential trends toward lower cigarette sales in ACL states predated ACL adoption, suggesting that estimated declines in tobacco sales post-ACL were partly or wholly a continuation of longer-term trends rather than the causal effects of cannabis policy.

Studies of adolescents (Coley et al., 2021, 2024; Hollingsworth et al., 2022) and college students (Kerr et al., 2018; Alley et al., 2020) also found statistically insignificant or significant negative associations between ACL adoption or dispensary openings and nicotine or tobacco use. However, none of these studies provided justification or support for their identifying assumptions, limiting confidence in causal interpretations of their findings.

Opioid Analgesics

Of the studies met our inclusion criteria and assessed how ACLs affected opioid analgesic prescribing or distribution, three relatively rigorous studies used datasets with national coverage across payer types. Two analyzed aggregate data on pharmacy distribution and found negative but statistically insignificant relationships between ACL adoption and per capita prescription opioid distribution overall, along with evidence of a pre-existing downward trend in ACL states (Nguyen et al., 2024; Raman et al., 2023). One of these studies, however, reported large and significant negative associations of ACL adoption with codeine distribution (Raman et al., 2023). Using all-payer individual-level prescription fill data, McMichael et al. (2020) found statistically significant reductions in all measures of opioid dispensing following ACL adoption. This

included reductions in total morphine milligram equivalents (MME; 12 percent), number of patients receiving opioids (6 percent), and the probability that a provider prescribed any opioids (3 percent). Subgroup analyses stratified by payer showed that these negative associations were driven by prescriptions among the commercially insured, Medicare beneficiaries, and recipients of government assistance programs. Similarly, Steuart et al. (2025)'s more-recent analyses using synthetic control methods and assessing the 2007–2020 period found significant declines in opioid prescription rates among the commercially insured. Earlier and less rigorous studies have also generally pointed toward lower opioid prescription fills and MME rates associated with ACL adoption (Noureldin et al., 2024; Grant et al., 2025; Cerdá et al., 2025; Wen et al., 2021) and proximity to retail cannabis dispensaries (Beasley and Dundas, 2024; Buttorf et al., 2023).

Findings for Medicaid specifically have been more mixed. McMichael et al. (2020) found significant increases in opioid prescriptions, while Shi et al. (2019) found significant decreases. Both studies, however, did not account for important possible confounders (e.g., Medicaid expansion) and did not test the identifying assumptions needed to interpret results causally.

A key limitation with this literature is that most studies evaluate ACL changes during a period of intense focus on the opioid crisis, a time marked by substantial changes to opioid prescribing policy at the national, state, and local levels, as well as in health care systems. Although there is little evidence that contemporaneous changes in opioid prescribing policy and practice are systematically correlated with state adoption or implementation of ACLs, it remains uncertain whether the findings of these studies would generalize to contexts with lower rates of inappropriate opioid prescribing or opioid analgesic misuse.

Other Substances

Nine quasi-experimental studies assessed the relationship between ACLs and use of illegal substances or misuse of prescription medications. Findings were mixed and often sensitive to model specification. This may reflect the limited statistical power of studies that assess the impacts of ACL on low prevalence outcomes such as self-reported cocaine or heroin use that are also often underreported or mismeasured in household surveys (Reuter, Caulkins, and Midgette, 2021). Although some researchers used proxy indicators (e.g., Google Trends, Bitcoin activity), these measures have not been validated and bear unknown relationships to patterns of substance use.³

Three of the more-rigorous studies (Ali et al., 2022; Hollingsworth et al., 2022; Sabia et al., 2024) found significant evidence that ACL adoption or the opening of retail cannabis stores increased illegal stimulant use or decreased opioid misuse. However, these estimates were imprecise and became small and statistically insignificant in many specifications. Two less

³ Yang et al. (2024) evaluated how changes in policy affected Google search interest in the keyword “microdosing,” which they interpreted as showing increased interest in psychedelic microdosing. Two less rigorous studies evaluated how cannabis policy changes affected activity on Bitcoin markets (Liu, Xie, and Chen, 2025; Shanaev et al., 2024).

rigorous studies using survey data from undergraduates (Alley et al., 2020; Kerr et al., 2018) and from the broader household population (Martins et al., 2025) also found statistically insignificant relationships between ACL adoption and illegal drug use or prescription drug misuse.

Two additional studies evaluated how ACLs affected legal distribution of non-opioid prescription medications. The more rigorous of these (Bradford et al., 2024) used synthetic control methods to match MCL and ACL states to states that had neither MCLs nor ACLs but were comparable on pre-policy trends. The authors found consistent evidence that ACLs were associated with significant reductions in benzodiazepine dispensing in a commercially insured population. Their preferred estimates showed a 15 percent decrease in the rate of patients dispensed benzodiazepines and a 5 percent decrease in the days' supply per prescription fill. These reductions occurred on top of significant declines already experienced in the transition from prohibition to MCL. The authors found less consistent evidence for the other drug classes analyzed, including antidepressants (suggestive increase), antipsychotics (suggestive increase), barbiturates (mixed and insignificant), and sleep medications (mixed and insignificant). A less rigorous study found an imprecise and statistically insignificant relationship between ACL adoption and distribution of prescription stimulant medication (Alexander et al., 2024).

Other Health Outcomes

Cannabis legalization may affect a variety of health outcomes through multiple pathways. Increased cannabis use could directly affect health through the pharmacological effects of THC and other cannabinoids on mental health, pain perception, and other physiological processes. Legalization may also affect health indirectly through changes in health care seeking, substitution of cannabis for more harmful substances, or changes in the safety profile of cannabis products. This section examines the evidence on how ACLs have affected health care use for cannabis-related conditions, mental health outcomes, and other health-related outcomes.

Summary of Effects on Other Health Outcomes

Evidence on adult-use cannabis legalization's impact on health care use shows consistent increases in cannabis-related poisonings, particularly after the implementation of retail sales. Effects were most pronounced among younger populations and varied with product availability. Treatment admissions for CUD have remained stable or declined despite increased prevalence of daily and near-daily use, likely reflecting changes in criminal justice referral patterns. Effects on mental health outcomes including suicide are mixed and inconclusive, with some evidence of heterogeneous effects across age groups and states.

Evidence from Quasi-Experimental Studies

Cannabis-Related Poisonings

Studies that examined the effect of cannabis legalization on cannabis-involved poisonings using poison call data and hospital administrative data generally found consistent effects despite methodological heterogeneity: Legalization alone showed mixed effects, but the opening of retail markets was consistently associated with increased cannabis-related poisonings across multiple jurisdictions and study designs.

Studies examining legalization alone found variable effects. Using commercial claims data from 2011 to 2021, Jaywardhara et al. (2024) documented a 31.6 percent relative increase (3.4 additional diagnoses per million enrollees quarterly) following legalization. However, Shi and Liang (2020) found no significant changes post-legalization but significant increases of 5.1 to 5.8 exposures per million population quarterly after retail sales. Klein et al. (2022) found a 37 percent reduction in poisonings attributable to synthetic cannabinoids, suggesting a potential substitution effect.

Cannabis-related poisoning effects disproportionately concern children. Myran et al. (2023) conducted an interrupted time series analysis in four Canadian provinces, finding a 2.7-fold increase in pediatric hospitalizations (ages 0 to 9 years) after initial legalization of dried flower, followed by an additional 2.2-fold increase after legalization of edibles in Ontario, Alberta, and British Columbia. Quebec, which prohibited edibles sales, experienced no further increase, highlighting the importance of product forms.

California studies also found age-specific effects. Matthay et al. (2024) found localities banning retail stores had 18 percent fewer youth exposures (ages 0 to 12) compared with those localities that permitted retail stores. Roth et al. (2022) similarly found poisonings increased among children younger than 13, with 2.07 additional monthly exposures post-legalization and 0.85 additional exposures after retail opening. Neither of these studies found statistically significant effects on exposures among older age groups.

Cannabis Use Disorder Treatment Admissions

Despite increases in daily and near-daily cannabis use among adults, effects on treatment admissions are complex and, at first glance, counterintuitive. Multiple studies found reduced or unchanged treatment use after legalization, suggesting altered treatment-seeking behaviors or referral patterns. Mennis, Stahler, and McKeon (2023) found no significant changes in CUD treatment admissions among adolescents or young adults despite documented increases in the prevalence of cannabis use. This disconnection between increased cannabis use and stable treatment rates for CUDs was corroborated by Mauro et al. (2024), who found no significant association between recreational legalization and specialty CUD treatment among those who met proxy criteria for a *Diagnostic and Statistical Manual of Mental Disorders*, 5th Edition (DSM-5)

diagnosis. The treated prevalence of CUDs remained extremely low at 1.8 percent to 2.5 percent of those who met proxy diagnostic criteria.

The most consistent finding in this literature has been a decline in criminal justice–referred treatment admissions for CUD among adults, although estimated effects are not always statistically significant. Mennis, Stahler, and McKeon (2023) documented that criminal justice referrals to CUD treatment declined significantly and substantially after legalization, but others have found smaller and less precise effects (Harris and Kulesza, 2023; Sabia et al., 2024).

Opioid Poisonings

A relatively large body of literature has evaluated the effects of ACLs on opioid overdose hospitalizations and mortality.⁴ Although many of these studies found that adult-use legalization and the opening of retail stores led to decreases in opioid-related mortality and opioid-related emergency department visits (Alcocer, 2020; Buttorff et al., 2023; Castillo-Carniglia et al., 2023; Chan et al., 2020; Drake et al., 2021; Hsu and Kovács, 2021; Marinello and Powell, 2023; Sabia et al., 2024), there are numerous caveats with these findings. Specifically, more recent evidence suggests that these reassuring findings may not generalize to contexts in which opioid-related overdoses or health care encounters are driven by illegal opioids (e.g., heroin, illicitly manufactured fentanyl).

Of note, Mathur and Ruhm (2023) found no statistically significant evidence that adult-use legalization or the opening of retail stores led to lower rates of opioid-related overdose mortality. Their preferred specification indicated that, while the incremental effect of adult-use legalization relative to allowing medical cannabis dispensaries was statistically insignificant, the combined effect of allowing medical cannabis and adult-use dispensaries was to *increase* opioid death rates. Their results highlight the need for a cautious interpretation and consideration of the particular context of opioid-related harm in a jurisdiction, as well as its other cannabis and substance use policies, when predicting the likely effects of a cannabis policy regime on opioid-related mortality.

Mental Health and Suicide

Evidence on mental health outcomes is mixed and inconclusive. Studies have examined the effects on psychosis and schizophrenia (e.g., Delling et al., 2019; Elser et al., 2023; Wang et al., 2022), but results are contradictory and the studies generally do not provide evidence to support that their methods are accurately picking up causal effects of legalization.

Several studies have examined the relationship between ACLs and suicide rates, with findings that vary substantially by state, age group, and study design. Methodologically stronger studies generally find small and imprecisely estimated effects on suicide in the overall

⁴ A few studies (e.g., Castillo-Carniglia et al., 2023 and Sabia et al., 2024) have examined the effects of adult-use legalization on poisonings involving non-opioid drugs, but findings from this literature are inconclusive.

population, although aggregate estimates may obscure offsetting effects across age groups. Some age-stratified analyses suggest that, relative to prohibition, adult-use legalization and retail market availability are associated with higher rates of suicide among adolescents (Hammond et al., 2023) and lower suicide rates among adults ages 45 to 64 years (Markowitz and Leinenbach, 2025). However, these subgroup findings should be interpreted cautiously: Suicide is a relatively rare outcome (particularly among youth), and finely stratified analyses combined with multiple hypothesis testing increase the risk of spurious statistically significant results.

Broader mental health outcomes have received less rigorous quasi-experimental attention. Some studies document increases in cannabis-related mental health diagnoses, but it remains unclear whether these reflect true increases in underlying conditions or changes in diagnosis patterns following legalization. The heterogeneity in findings across populations and methodologies precludes definitive conclusions about the causal effects of ACLs on mental health outcomes. Still, findings that ACL adoption and the opening of retail stores increase cannabis use among individuals with mental disorders (e.g., psychosis) (Hyatt et al., 2025) highlights a need for continued monitoring and consideration when deciding on cannabis policies and regulations.

Pain

The peer-reviewed quasi-experimental literature on how ACLs affect pain management and pain-related outcomes is limited, with most evidence coming from observational studies of medical cannabis patients. Observational studies suggest that some adults use cannabis as a substitute for opioids in managing chronic pain (Boehnke et al., 2019). Survey studies of patients in medical and recreational cannabis states found that substantial proportions report reducing or eliminating opioid use after initiating cannabis treatment (Pritchett et al., 2022). However, these studies cannot establish causality and are subject to selection bias, because individuals who successfully substitute cannabis for opioids may differ systematically from those who do not. Randomized controlled trials of the efficacy of cannabinoids as adjunctive treatments for chronic pain found some significant but quite small benefits of cannabis relative to placebo, with varied findings across cannabinoids tested and underlying pain conditions (Chou et al., 2025; National Academies of Sciences, Engineering, and Medicine, 2017).

The quasi-experimental evidence on opioid prescribing reductions (reviewed above) provides some indirect support for pain-related substitution effects but does not specifically examine pain outcomes. Research remains sparse on how legalization affects pain prevalence, pain management practices, or patient-reported pain outcomes using rigorous causal designs.

Traffic Crashes and Mortality

Traffic safety outcomes are among the most cited concerns in cannabis policy debates. Driving under the influence of cannabis impairs reaction time, attention, and decisionmaking, although the magnitude of impairment and crash risk associated with cannabis is generally

smaller than that associated with alcohol (Hartman and Huestis, 2013). However, increased cannabis use following legalization could translate into more impaired driving, more traffic crashes, and more fatalities—particularly if legalization increases the prevalence or frequency of cannabis use in populations that are the most likely to engage in risky driving behaviors (e.g., young adults), or if it increases driving after cannabis is used in conjunction with alcohol.

Summary of Effects on Traffic Crashes and Mortality

Evidence of the effects of adult-use cannabis legalization on traffic safety is highly inconsistent and varies by stage of policy implementation and geographic location. Studies examining legalization generally find no statistically significant effects on traffic fatalities, but those examining retail sales implementation show patterns of greater concern, albeit with substantial heterogeneity across states. Findings from Colorado consistently show significant increases in traffic crashes and mortality, while evaluations of Washington and Oregon show largely null effects. The divergent findings likely reflect differences in implementation characteristics, enforcement practices, and concurrent policy changes related to driving across jurisdictions.

Traffic Fatalities After Adult-Use Legalization

Most studies that examined traffic fatalities following adult-use legalization found no statistically significant changes (Aydelotte et al., 2019; Chen and French, 2023; Dewey et al., 2021; Hansen, Miller, and Weber, 2018). Among eight methodologically stronger U.S. studies, most of which used the Fatality Analysis Reporting System (FARS) data, effects varied considerably by state. For example, Santaella-Tenorio et al. (2020) found a significant increase of 0.46 deaths per billion vehicle miles traveled (BVMT) in Colorado but no change in Washington State.

Traffic Fatalities After Retail Market Opening

Studies that examined traffic fatalities following the opening of retail cannabis markets produced stronger evidence of harmful effects. Multiple multistate analyses found consistent increases of 1.5 to 2.1 fatalities per BVMT. Adhikari et al. (2023) documented a 1.2 per BVMT increase using 2007 to 2020 FARS data and statistical methods to address inaccuracies that can occur in some DID designs when there are heterogeneous policy effects and staggered policy adoption. Aydelotte et al. (2019) found 1.6 additional fatalities per BVMT, while Kamer et al. (2020) reported 2.1 additional fatalities.

However, state-specific analyses reveal some heterogeneity. Colorado consistently showed increases in traffic fatality rates—Santaella-Tenorio et al. (2020) found 1.46 additional deaths per billion VMT annually, corroborated by Marinello and Powell (2023) and Calvert and Erickson (2020). Washington State showed mixed results, with most studies finding no significant changes. Oregon similarly showed null effects in most analyses (Lane and Hall,

2019). County-level analysis within Colorado found no association between retail store presence and traffic fatality rates (Gunadi, 2022).

The stronger association of traffic safety with retail sales relative to legalization alone suggests accessibility and commercialization may be key moderating factors. At the same time, the substantial heterogeneity in policy effects across states limits the generalizability of findings to states that may legalize in future.

Employment and Other Economic Outcomes

Adult-use cannabis policies can affect economic outcomes directly by creating a newly legal industry (if one is permitted under the law) and potentially indirectly by producing changes in substance use, health, and criminal activity, educational attainment, labor market performance, reliance on economic support programs, and investment in local housing and businesses.

The creation of a legal cannabis market can potentially affect the economic functioning of a state through the collection of additional tax revenue, fees, or tourism. Legalization can increase employment and industry growth in a newly created legal sector and produce capital inflows with investment in cannabis producers, retailers, and ancillary service providers. Theoretically, ACL adoption should increase legal economic activity (e.g., labor force participation, gross domestic product) in cannabis-related industries, although some of these economic benefits may be offset by declines in employment or economic activity in other sectors.

The nature and direction of the possible indirect effects of cannabis policy changes on labor markets and other economic indicators are uncertain. They could include the possible effects of increased cannabis use or other substance use on health, motivation, productivity, academic achievement, absenteeism, and other behaviors in the workplace (e.g., workplace accidents). These effects in aggregate could be beneficial or harmful depending on the extent to which increased cannabis use reduces the use of other intoxicating substances, and whether it improves or worsens health problems. The ability to consume cannabis legally may also induce migration to the state. The growth in the retail market for cannabis (if allowed) can reshape neighborhoods and local businesses in ways that affect community- or state-level economic outcomes.

By removing criminal penalties or expunging criminal records associated with cannabis offenses, legalization may improve labor market opportunities for individuals who would otherwise have faced barriers because of a criminal record (see Wakefield, Bialous, and Apollonio [2023] for review of cannabis policies related to expungement; as well as Pager [2003], Bushway [2004], and Agan and Starr [2017] for broader discussion of labor market barriers).

Summary of Effects on Employment and Other Economic Outcomes

Most evidence indicates that the implementation of adult-use cannabis legalization can increase employment in some populations and industry sectors, although there is no evidence of significant overall effects on wages or earnings. Evidence for effects on other forms of income

support (WC benefits, social security disability insurance) is mixed but suggests that commercial cannabis markets may produce some labor market benefits for older adults and harms for young adults. Finally, although there is weaker evidence that allowing commercial markets for cannabis increase tourism and induce migration to the state, these effects may be attenuated in later-adopting states.

Evidence from Quasi-Experimental Studies

Employment and Earnings

Overall, quasi-experimental evidence suggests that, in the short run, there may be increased economic activity and employment in sectors that conduct cannabis-related business. However, the effects of adult-use legalization on labor markets are likely to be very small. In their recent multistate study of the effects of ACL adoption and dispensary openings,⁵ Dave et al. (2025) found statistically insignificant increases in overall employment and wages, typically less than 1 percent in magnitude. However, industry-specific estimates showed an increase in agriculture employment, with magnitudes of about 0.1 to 0.2 percentage points (10 percent to 20 percent increases relative to the pretreatment mean). State-specific estimates indicated that there were significant increases in agricultural employment primarily in Washington state, Colorado, and California that were consistent with the results of prior observational studies (Chakraborty et al., 2021; Jiang and Miller, 2022). Other studies have found increased tourism (Meehan, Rusko, and Stephenson, 2020), in-migration (Zambiasi and Stillman, 2019); and college applications, enrollments, and graduations from large public schools (Blake, Thomas, and Hess, 2023) after commercial markets opened in Colorado and Washington state. Because these were the first U.S. states to begin legal cannabis sales, and both promoted canna-tourism, these effects are unlikely to generalize⁶ to later-adopting states or states that have placed greater restrictions on legal cannabis supply.

Workplace Injuries

Some studies have found large effects of legalization on the receipt of WC benefits and workplace injuries that differ between younger and older populations. Comparing trends in ACL-adopting states with non-adopters—and adjusting for state-level differences in other cannabis policies (e.g., medical cannabis legalization, decriminalization), substance use policies, socioeconomic, and demographic characteristics—Li et al. (2024) found that ACLs were

⁵ These effects are estimated as the marginal effect of implementing ACL policies on top of MCL policies. Dave et al. (2025) did not present results for MCL adoption, so we cannot describe their estimates for the combined effect of allowing both MCL and ACL or MCL alone relative to prohibition.

⁶ Although Maclean et al. (2020) found significant migration inflows associated with ACL adoption averaged across multiple states, migration outcomes were not the focus of the study, and the authors did not show evidence to justify their models' identifying assumptions.

associated with a statistically significant 12 percent increase in workplace injuries among young adults ages 20 to 34 years.⁷ However, using a similar study design to examine outcomes in individuals ages 40 to 62 years, Abouk et al. (2023) found that ACL adoption led to a statistically significant short-term reduction in probability of WC benefit receipt and a significant reduction in annual WC income. The magnitudes of the estimated effect sizes were large: an approximate 20 percent reduction compared with counterfactual baselines. In analyses of possible mechanisms, the authors estimated that this population showed significant declines in self-reported work-limiting disabilities and Social Security Disability Insurance (SSDI) income, significant increases in employment, and statistically insignificant effects in nonfatal workplace injuries. The authors did not validate the identifying assumptions of their models in testing these mechanisms, and results from a separate study (Maclean et al., 2020) found statistically significant increases in SSDI applications and Supplemental Security Income (SSI) approvals after ACL adoption and dispensary opening, respectively. These conflicting findings limit our confidence in the strength of conclusions that can be drawn about the effects of ACLs on disability claims.

Evidence from Other Studies

Productivity and Educational Attainment

Most of the evidence on the relationship between cannabis use and productivity or labor market performance is observational and so cannot distinguish between the causal effects of cannabis use from the effects of other confounding factors that are related to the decision to use cannabis and to the educational or economic outcomes of interest. A few studies have used designs that better disentangle these relationships.

The best causal evidence indicates that heavy and early marijuana use may modestly impair educational progress (Roebuck, French, and Dennis, 2004; van Ours and Williams, 2015), but typical or occasional use shows small or statistically insignificant effects once confounding is addressed (Grant et al., 2012). This evidence base has primarily been generated in contexts in which cannabis is prohibited. The effects of cannabis use on academic achievement may change when cannabis products are more diverse, more potent, widely available, use is socially acceptable, and cannabis is heavily marketed. For example, in a study exploiting changes to legal cannabis availability based on citizenship in the Netherlands, Marie and Zölitz (2017) found that students who were no longer legally permitted to buy cannabis had significantly improved course

⁷ Dong (2021) used Oregon workplace injury claim data and found that Oregon counties with retail cannabis sales had a significant increase in the fraction of claims reported on a Monday, as well as the number of Monday claims, relative to contemporaneous trends in Oregon counties that did not allow (or yet allow) cannabis sales. However, without understanding trends in claims on other days of the week, the policy implications of these findings are unknown.

grades (particularly in courses involving numerical skills) compared with peers who could still legally buy cannabis.

Evidence on productivity and labor market performance that supports causal inferences is more limited. Early observational studies (Zwerling et al., 1990; Hoffmann et al., 2007; Okechukwu et al., 2019) linked cannabis use to higher rates of job loss and turnover, but these estimates were subject to confounding and did not distinguish between current and past use of cannabis. Concerns about cannabis use and productivity or workplace safety are likely to be more relevant to on-the-job use. For example, an observational study in Canada found no significant difference in workplace injury risk for workers who did not use cannabis in the past year and those who used cannabis in nonworkplace settings, but workers who used cannabis in the workplace were nearly twice as likely to experience a workplace injury (Carnide et al., 2023). Those who use cannabis in the workplace, however, may have other risk factors for injury. Taken together, the limited causal evidence suggests that heavy or persistent use of cannabis may have small, short- to mid-term adverse effects on productivity and job performance. There is little indication that it may have large or longer-lasting impacts once underlying risk factors and co-occurring behaviors are considered. Furthermore, the use of other substances, such as alcohol and opioids, appears to be more strongly related to impaired cognitive functioning and job performance than cannabis use (Yörük, 2015; Zacny, 1995; Blum, Roman, and Martin, 1993).

Home Prices

Although outside the scope of outcomes originally included in our systematic search protocol, we identified a small quasi-experimental literature evaluating how ACLs affect housing markets. Several studies have examined the relationship between cannabis legalization and housing prices using DID or hedonic pricing approaches. Three working papers used DID approaches to compare changes in statewide housing prices before and after ACL adoption with contemporaneous housing price trends in non-ACL states; they found that ACLs or the opening of cannabis dispensaries increase home values by five to fifteen percent (Barrios, Jennings, and Kim, 2024; Brown, Cohen, and Felix, 2024; Kim, O'Connor, and Norwood, 2020).

Another strand of literature has looked specifically at the role of dispensary proximity in determining housing prices. Cheng, Mayer, and Mayer (2018) found that adult-use cannabis legalization in Colorado was associated with a six percent increase in housing prices statewide, with effects that varied with proximity to dispensaries. More geographically fine-grained analyses of Denver, Colorado found similar effect sizes (Burkhardt and Flyr, 2018; Conklin, Diop, and Li, 2017). Studies examining localized effects near dispensaries in other jurisdictions have found mixed results (Thomas and Tian, 2021; Tyndall, 2019): Some found modest price premiums for homes near retail outlets and others found no significant effects or price discounts.

These findings should be interpreted cautiously given the challenges in establishing causality in housing market studies. Housing prices are influenced by numerous factors that may be correlated with cannabis policy adoption, and the cross-state variation in the timing of

legalization may be confounded by other economic trends. Additionally, the effects observed in early-adopting states may not generalize to later adopters because the novelty factor and tourism-related demand may dissipate as more states legalize. Finally, dispensary locations are not randomly assigned, and siting decisions may correlate with other neighborhood characteristics that independently affect housing values.

Social Outcomes

This section examines evidence on the effects of cannabis legalization on population change (migration), crime and criminal justice outcomes, and homelessness. These outcomes are interconnected with each other, as well as with the economic outcomes reviewed above. Changes in migration patterns may be due to the direct amenity value of legal cannabis access or changes in local employment opportunities and social conditions with a newly established industry. Changes in population size and composition may affect criminal activity and public disorder, while changes in crime and criminal justice involvement may directly affect individuals' economic prospects and housing stability.

Summary of Effects on Social Outcomes

The most robust finding in this domain is a reduction in cannabis possession arrests: Legalization produces large and consistent reductions in adult arrests, with decreases of 40 percent to 73 percent in multiple rigorously designed studies. Effects on violent and property crime are generally null and inconsistent, with the methodologically strongest studies finding no significant changes. Evidence on migration suggests small positive effects on in-migration to early adopting states, although these effects may have been attenuated for later adopters. Peer-reviewed evidence on homelessness and housing stability is extremely limited.

Evidence from Quasi-Experimental Studies

Population Change

Several studies have examined whether cannabis legalization affects population change through migration patterns. It could work in either direction: Legalization may attract in-migration from individuals who value legal access to cannabis while deterring migration among those who believe that legalization is associated with negative quality-of-life effects.

There were small increases in in-migration to early adopting states. Zambiasi and Stillman (2019) found that recreational cannabis legalization in Colorado and Washington state was associated with a 2 percent to 3 percent increase in in-migration, with effects concentrated among adults younger than 30 years of age. Blake, Thomas, and Hess (2023) found increases in college applications, enrollments, and graduations from large public schools in Colorado and Washington state after retail market opening. However, because these were the first U.S. states to begin cannabis sales and both promoted canna-tourism, these effects are unlikely to generalize to

later adopting states. As more states have legalized, the amenity value of legal access in any particular state has diminished.

Crime and Arrests

Fourteen studies that met our inclusion criteria examined the impact of adult-use cannabis legalization policies on cannabis possession arrest rates among adults and youth. Most of the identified studies were from the United States and used data from the same source: the Uniform Crime Reporting (UCR) program, albeit collected for different years, jurisdictions, and using different methodologies.

In the case of cannabis possession arrests among adults, most studies have demonstrated a statistically significant decrease after adult-use legalization and retail market opening. The magnitudes of change differed according to which states were included as the treated units and control groups and by demographic characteristics. Hollingsworth et al. (2022) and Gunadi and Shi (2022) used UCR data and DID approaches but differed in the years they examined. Hollingsworth et al. (2022) used data between 2002 and 2017 and demonstrated a statistically significant decrease in adult arrests for cannabis possession after adult-use legalization (–57.1 percent) and the opening of retail markets (–55 percent). Gunadi and Shi (2022) found that adult-use legalization was associated with a statistically significant decrease in arrest rates between 2010 and 2019 for cannabis possession (–40 percent) in states that had previously decriminalized cannabis and a decrease of 73 percent in states that had not previously decriminalized cannabis.

The studies that examined the effects of adult-use cannabis policy changes on youth cannabis possession arrests and used stronger methodologies have not found a statistically significant change in youth cannabis possession arrest rates after adult-use legalization or retail market opening (Gunadi and Shi, 2022; Hollingsworth et al., 2022; Plunk et al., 2019).

Evidence on the effects of legalization on non-cannabis crime is more limited and generally shows null effects. Several studies examined violent crime and property crime outcomes and did not find statistically significant effects of legalization. The limited evidence does not support claims that legalization either substantially increases or decreases criminal activity other than cannabis possession.

Homelessness

There is limited peer-reviewed quasi-experimental literature on how ACLs affect homelessness. One Federal Reserve working paper (Brown, Cohen, and Felix, 2024) examined the relationship between adult-use cannabis legalization and homelessness using point-in-time count data. The authors found that legalization was associated with a 35 percent increase in the homeless population in early adopting states, with effects concentrated in urban areas. However, because this study has not been peer reviewed its findings should be interpreted cautiously.

In theory, legalization could either increase or decrease homelessness. Increasing legal access to cannabis could increase homelessness if it increases migration to the state by individuals with

substance use disorders or limited economic resources, or if increased cannabis use displaces spending on housing or exacerbates mental health conditions. Legalization could reduce homelessness if the removal of criminal penalties reduced criminal justice involvement (which is strongly associated with risk of homelessness [Caton et al., 2005]) or if cannabis tax revenues were directed toward housing and social services. The limited evidence base does not allow any conclusions about the causal effect of legalization on homelessness.

State Budgets

Summary of Effects on State Budgets

Identifying the net effect of legalization on state and local budgets would be challenging to undertake given the multiple ways in which ACLs affect, not only the budget directly related to cannabis tax revenues and costs associated with cannabis regulation and enforcement, but also the budgets of multiple other state and local agencies (e.g., law enforcement, health care organizations). The limited evidence that does exist suggests a possible modest net increase in tax revenue, with direct gains from cannabis sales partially offset by declines in tax revenues from other categories. However, effects seem to have attenuated for later-adopting states versus early adopters and may depend critically on prices and availability of legal cannabis from alternative markets (including neighboring jurisdictions with legalization, illegal markets, among others), as well as such factors as the tax base (e.g., price or potency), excise tax rate, and state sales tax. Without better evidence of how legalization affects regulatory and enforcement costs—as well as cost increases or offsets from the effect of ACLs on a broad variety of economic, health, and crime outcomes—the net effect of state budgets is highly uncertain.

Evidence from Quasi-Experimental Studies

Our search identified no peer-reviewed quasi-experimental studies that conducted an empirical examination of the net effects of ACL policies on state or local budgets.⁸ However, one Federal Reserve working paper (Brown, Cohen, and Felix, 2024) examined the relationship between adult-use cannabis legalization and a broad variety of economic and social outcomes, including tax revenues. Using DID methods developed to produce more-accurate estimates of average policy effects when effects of policies vary across place and over time, the authors estimated a statistically significant increase in annual cannabis tax revenue of approximately \$19 per person following legalization. The average effect they estimate masks substantial heterogeneity across states. The largest increases in cannabis tax revenues are accrued by the earlier adopting states (Washington state and Colorado), with much more-muted effects for later adopters.

⁸ The few studies that examined effects of adult-use cannabis legalization on alcohol and tobacco tax revenues are noted previously in the section on effects of legalization on other substance use.

Looking at total state tax revenues and sales revenues, the authors found that ACL adoption had a small and statistically insignificant effect on tax revenue and sales tax revenues overall, with enough uncertainty around their estimated effects such that they could not rule out relatively large effects in either direction (in part because cannabis tax revenues are relatively small compared with total state budgets). They found some evidence of declines in alcohol and tobacco tax revenues, highlighting the importance of considering spillover effects of cannabis use to use of other tax-generating products or services. Because this study has not undergone peer review, and some of their outcome data are of unknown reliability and were produced by advocacy organizations, these findings should be interpreted cautiously.

Evidence From Other Studies

Descriptive information on cannabis tax revenues in states that have adopted ACLs may offer some further insights on the budgetary impacts of legalization. Table 3 highlights the different tax regimes that have been implemented in U.S. states, the 2024 state revenues from cannabis taxes, and a few different approaches for comparing states: Cannabis tax revenues per person or per past-month user. Because the 2025 tax revenues are not readily available for all states, we limit this table to the 20 states that had cannabis stores open before 2024. As of January 2025, none of these states has used the same approach to setting cannabis excise taxes. A more detailed comparison would also incorporate the state/local sales taxes.

Table 3. Cannabis Tax Regimes and Revenues for 19 States

State	Adult-Use Sales Start Date	State Excise Tax Rates on Recreational Marijuana, as of January 2025	Ballpark^a Cannabis Tax Revenues (2024, \$ Millions)	State Population (2024, Millions)	2023/24 Past-Month Cannabis % (12+)	Cannabis Tax Revenue per Person	Ballpark^a Tax Revenue per Past-Month User
Colorado	Jan 2014	15% on wholesale average market rate (\$658 per pound of bud); 15% on retail sales	\$237	6.0	23.7	\$40	\$168
Washington	Jul 2014	37% on retail sales	\$517	8.0	17.9	\$65	\$362
Oregon	Oct 2015	17% on retail sales	\$154	4.3	22.0	\$36	\$164
Alaska	Oct 2016	\$50/oz. mature flowers; \$25/oz. immature flowers; \$15/oz. trim; \$1 per clone	\$26	0.7	21.2	\$36	\$169
Nevada	Jul 2017	15% on wholesale fair market value (\$1,296 per pound of flower); 10% on retail sales	\$171	3.3	19.9	\$52	\$263

State	Adult-Use Sales Start Date	State Excise Tax Rates on Recreational Marijuana, as of January 2025	Ballpark ^a Cannabis Tax Revenues (2024, \$ Millions)	State Population (2024, Millions)	2023/24 Past-Month Cannabis % (12+)	Cannabis Tax Revenue per Person	Ballpark ^a Tax Revenue per Past-Month User
California	Jan 2018	15% on retail gross receipts	\$1,009	39.4	15.5	\$26	\$166
Massachusetts	Nov 2018	10.75% on retail sales	\$283	7.1	20.2	\$40	\$196
Michigan	Dec 2019	10% on retail sales	\$524	10.1	20.3	\$52	\$255
Illinois	Jan 2020	7% on wholesale gross receipts; 10% on retail sales of cannabis products with ≤35% THC; 20% on retail sales of cannabis-infused products, such as edibles; 25% on retail sales of any product with a THC concentration >35%	\$577	12.7	18.0	\$45	\$253
Maine	Oct 2020	10% on retail sales; \$335/lb. flower; \$94/lb. trim; \$35 per mature plant; \$1.5 per immature plant or seedling; \$0.30 per seed	\$42	1.4	25.5	\$30	\$118
Arizona	Jan 2021	16% on retail sales	\$253	7.6	17.1	\$33	\$195
Montana	Jan 2022	20% on retail sales	\$56	1.1	23.3	\$49	\$210
New Jersey	Apr 2022	\$2.50 per ounce	\$65	9.5	14.4	\$7	\$47
New Mexico	Apr 2022	12% on retail sales	\$77	2.1	22.5	\$36	\$160
Vermont	Oct 2022	14% on retail sales	\$28	0.6	25.2	\$43	\$170
Rhode Island	Dec 2022	13% on retail sales	\$16	1.1	20.1	\$14	\$72
Connecticut	Jan 2023	3% on retail sales; \$0.00625 per milligram of THC in plants; \$0.0275 per milligram of THC in edibles; \$0.009 per milligram of THC in other cannabis products; \$1 per THC infused beverage	\$33	3.7	18.9	\$9	\$47
Missouri	Feb 2023	6% on retail sales	\$131	6.2	21.6	\$21	\$97
Maryland	Jul 2023	9% on retail sales	\$73	6.3	14.8	\$12	\$79

SOURCES: Store opening dates: Wilk et al., 2025. Tax bases and rates: Hoffer and Macumber-Rosin, 2025; Revenues: Marijuana Policy Project, 2025; State populations: U.S. Census, 2024; Cannabis prevalence rates: SAMHSA, 2026.

State	Adult-Use Sales Start Date	State Excise Tax Rates on Recreational Marijuana, as of January 2025	Ballpark ^a Cannabis Tax Revenues (2024, \$ Millions)	State Population (2024, Millions)	2023/24 Past- Month Cannabis % (12+)	Cannabis Tax Revenue per Person	Ballpark ^a Tax Revenue per Past- Month User
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NOTES: States are ordered by adult-use cannabis sales start date. Excludes New York because of the very slow implementation and changes in tax base.

^a We consider these Marijuana Policy Project (2025) revenue figures as ballpark estimates for 2024 for multiple reasons: (1) some estimates are for the fiscal year versus the calendar year; (2) localities can apply different sales taxes and this variation may not be incorporated into the estimates; and (3) some of these estimates may not include local cannabis excise taxes. Our preliminary assessment of several state government cannabis websites in comparison with the Marijuana Policy Project (2025) data indicates that the data are relatively accurate.

Through 2024, U.S. states have collected more than \$24 billion in cumulative cannabis tax revenues. There is significant variation across states that reflect differences in tax rates, market structures, and time since legalization. In 2024 alone, California collected approximately \$1 billion in cannabis excise taxes, while Washington collected closer to \$500 million (Table 3). Tax revenues in 2024 for many states are below their peak in 2021. Looking at states that have experienced about a decade with ACLs, nominal cannabis tax revenues in 2024 were 10 percent to 40 percent below the 2021 value (Daly, 2026). Adjusting for inflation would imply even greater declines. Although reasons underlying the substantial declines in tax revenues are not well understood, they are evidence of the importance of considering the likely dynamic effects of a given tax policy regime. As markets expand, revenues from ad valorem taxes may initially increase with rapidly growing sales, but as competition pushes prices lower, taxes tied to prices may eventually yield less revenues.

Additionally, gross cannabis tax revenue figures do not account for the full fiscal picture. Costs associated with regulatory oversight, enforcement against illicit markets, and any increases in health care or social service use reduce the net fiscal benefit. There may also be declines in tax revenues from other sections. For example, one analysis suggests that approximately 40 percent of cannabis tax revenues in Washington state may have been offset by reduced revenues from alcohol and tobacco taxes in the first calendar year of legalization (Miller and Seo, 2021). That said, the experience of early adopting states may not generalize to later adopting states because competition from legal markets in neighboring states and the persistence of illicit markets may constrain tax revenue potential.

Discussion

Taken together, the experiences with legalization of adult-use cannabis use and sales have yielded a few consistent findings. The strongest and most predictable impacts are those most directly tied to the removal of prohibition: large and significant reductions in cannabis-related arrests and increases in cannabis use among adults. The creation of a commercial industry also produces some relatively predictable effects, such as expanding the variety of cannabis products of higher THC concentration and the generation of cannabis-specific tax revenue. Economic benefits from a newly established industry are possible, but many of these benefits (e.g., tourism, in-migration, housing value appreciation) appear to have been most pronounced in the early adopting states. As legalization has expanded to more states, and as alternative hemp-derived products have become more widely available, these economic benefits have likely attenuated and may have lower relevance for future policy decisions. Overall, the aggregate effects of adult-use legalization on statewide employment, wages, and earnings are likely to be small and unlikely to be a major driver of overall economic growth.

When it comes to implications for public health, safety, and social outcomes, the decision to legalize adult-use cannabis matters less than decisions about whether to allow and how to regulate commercial markets for cannabis. And the experience of other states that have allowed retail cannabis stores to operate has not yielded particularly conclusive findings. Available evidence does not support large declines in public safety following legalization or commercialization, but there is also no evidence of significant benefits. Similarly, at the aggregate population level, the existing literature has generally found inconclusive evidence for how adult-use cannabis legalization affects public health, crime, and other social outcomes. These inconclusive findings may indicate that the overall effects of cannabis laws on these outcomes are relatively small and difficult to detect, but the small overall effects may obscure large effects among certain subgroups. Increased cannabis-related poisonings among youths and increased use among individuals with mental health conditions suggests the importance of monitoring and considering interventions to reduce cannabis exposure and problematic use among higher-risk populations.

The existing evidence, while limited in many respects, points to a few important considerations for cannabis policy discussions in Indiana, which does not allow medical cannabis or adult-use cannabis and is already bordered by several states with robust adult-use cannabis markets. First, regulation and enforcement of retail markets matter more than legalization alone. Decisions regarding the number of retail licenses, geographic dispersion of outlets, product potency limits, and marketing restrictions will likely play a central role in shaping public safety outcomes. Given that Indiana does not have a preexisting medical cannabis market to accommodate, Indiana may have more options when it comes to retail market design and implementation. Second, potential economic gains in the cannabis sector need to be contextualized within Indiana's hemp agricultural market. An unknown share of hemp-derived

products in Indiana currently comes from multiple out-of-state sources, the upcoming 2026 change in federal policy may change that landscape. If a goal of cannabis policy is to improve the economic wellbeing of Indiana businesses, one needs to jointly consider agricultural hemp, hemp-derived products, and cannabis regulation (including potentially preferential licensing for existing hemp producers). Third, criminal justice impacts in the short term may have longer-term effects. Reducing cannabis-related arrests, which can be accomplished by such policies as decriminalization rather than legalization per se, may have additional benefits for reducing the collateral consequences of a criminal record, including adverse effects on employment, housing, and economic stability.

Finally, policy flexibility and evaluation are crucial: The literature demonstrates that short-term effects are unlikely to reflect longer-term dynamics, and that the details of implementation and context matter. Given that Indiana is unique from prior ACL adopters, the state could benefit from building in flexibility to adjust regulations in response to observed outcomes and to monitor how outcomes are evolving. Investments in state-level data infrastructure—linking public safety, health, labor, and housing data—could improve the ability of policy evaluations to distinguish causal effects from underlying trends.

Additional Detail on Extracted Studies

Table 4. List of 244 Extracted Studies that Met Inclusion Criteria from Rapid Evidence Assessment of Quasi-Experimental Studies

ID	Study Bibliographic Information
1	Abouk, R., K. M. Ghimire, J. C. Maclean, and D. Powell, "Pain Management and Work Capacity: Evidence from Workers' Compensation and Marijuana Legalization," <i>Journal of Policy Analysis and Management</i> , 2023.
2	Adhikari, K., A. Maas, and A. Trujillo-Barrera, "Revisiting the Effect of Recreational Marijuana on Traffic Fatalities," <i>International Journal of Drug Policy</i> , Vol. 115, 2023.
3	Alcocer, J. J., "Exploring the Effect of Colorado's Recreational Marijuana Policy on Opioid Overdose Rates," <i>Public Health</i> , Vol. 185, 2020.
4	Alexander, G. D., L. R. Cavanah, J. L. Goldhirsh, L. Y. Huey, and B. J. Piper, "Recreational cannabis legalization: no contribution to rising prescription stimulants in the USA," <i>Pharmacopsychiatry</i> , Vol. 57, No. 5, 2024.
5	Ali, M. M., C. McClellan, R. Mutter, and D. I. Rees, "Recreational Marijuana Laws and the Misuse of Prescription Opioids: Evidence from National Survey on Drug Use and Health microdata," <i>Health Economics</i> , Vol. 32, No. 2, 2023.
6	Alley, Z. M., D. C. Kerr, and H. Bae, "Trends in College Students' Alcohol, Nicotine, Prescription Opioid and Other Drug Use After Recreational Marijuana Legalization: 2008–2018," <i>Addictive Behaviors</i> , Vol. 102, 2020.
7	Anderson, D. M., B. Hansen, D. I. Rees, and J. J. Sabia, "Association of Marijuana Laws with Teen Marijuana Use: New Estimates from the Youth Risk Behavior Surveys," <i>JAMA Pediatrics</i> , Vol. 173, No. 9, 2019.
8	Anderson, D. M., D. I. Rees, J. J. Sabia, and S. Safford, "Association of Marijuana Legalization with Marijuana Use Among US High School Students, 1993–2019," <i>JAMA Network Open</i> , Vol. 4, No. 9, 2021.
9	Anderson, D. M., H. T. Fe, Y. Liang, and J. J. Sabia, "Recreational marijuana laws and teen marijuana use, 1993–2021," <i>JAMA Psychiatry</i> , Vol. 81, No. 8, 2024.
10	Anderson, K. K., R. Rodrigues, B. Le, M. Mamun, S. Archie, J. Edwards, T. Elton-Marshall, J. Gilliland, D. T. Myran, L. Palaniyappan, and C. M. Perlman, "Impact of non-medical cannabis legalization with market restrictions on health service use and incident cases of psychotic disorder in Ontario, Canada," <i>International Journal of Drug Policy</i> , Vol. 123, 2024.
11	Armstrong, M. J., N. Cantor, B. T. Smith, R. Jesseman, E. Hobin, and D. T. Myran, "Interrupted Time Series Analysis of Canadian Legal Cannabis Sales During the COVID-19 Pandemic," <i>Drug and Alcohol Review</i> , Vol. 41, No. 5, 2022.
12	Armstrong, M. J., "Canada's recreational cannabis legalization and medical cannabis patient activity, 2017–2022," <i>American Journal of Public Health</i> , Vol. 114, Suppl. 8, 2024.
13	Armstrong, M. J., R. MacDonald-Spracklin, J. Xiao, R. Talarico, and D. T. Myran, "Changes in population-level alcohol sales after non-medical cannabis legalisation in Canada," <i>Drug and Alcohol Review</i> , Vol. 44, No. 3, 2025.
14	Aydelotte, J. D., A. L. Mardock, C. A. Mancheski, S. M. Quamar, P. G. Teixeira, C. V. Brown, and L. H. Brown, "Fatal Crashes in the 5 Years After Recreational Marijuana Legalization in Colorado and Washington," <i>Accident Analysis and Prevention</i> , Vol. 132, 2019.
15	Bae, H., and D. C. Kerr, "Marijuana Use Trends Among College Students in States with and Without Legalization of Recreational Use: Initial and Longer-Term Changes From 2008 to 2018," <i>Addiction</i> , Vol. 115, No. 6, 2020.
16	Baggio, M., and A. Chong, "Recreational Marijuana Laws and Junk Food Consumption," <i>Economics and Human Biology</i> , Vol. 39, 2020.

ID	Study Bibliographic Information
17	Baggio, M., A. Chong, and R. Suryanarayana, "High times and troubled relationships: Recreational marijuana laws and intimate partner violence," <i>Economics and Human Biology</i> , Vol. 54, 2024.
18	Bai, Y., P. Cao, C. Kim, K. Ienciu, and A. Chum, "The Impact of Recreational Cannabis Retailer Allocation on Emergency Department Visits: A Natural Experiment Utilizing Lottery Design," <i>International Journal of Drug Policy</i> , Vol. 137, 2025.
19	Blalthrop, A., J. Phares, R. Gordon, and A. Scott, "Marijuana Legalization and Truck Safety," <i>Journal of Business Logistics</i> , Vol. 45, No. 4, 2024.
20	Barker, A. K., and M. A. Moreno, "Effects of Recreational Marijuana Legalization on College Students: A Longitudinal Study of Attitudes, Intentions, and Use Behaviors," <i>Journal of Adolescent Health</i> , Vol. 68, No. 1, 2021.
21	Bass, B., H. Padwa, D. Khurana, D. Urada, and A. Boustead, "Adult use cannabis legalization and cannabis use disorder treatment in California, 2010–2021," <i>Journal of Substance Use and Addiction Treatment</i> , Vol. 162, 2024.
22	Beasley, W. J., and S. J. Dundas, "Recreational cannabis dispensary access effects on prescription opioid use and mortality," <i>Regional Science and Urban Economics</i> , Vol. 108, 2024.
23	Bednarek, Z., J. M. Doremus, and S. S. Stith, "US Cannabis Laws Projected to Cost Generic and Brand Pharmaceutical Firms Billions," <i>PLOS One</i> , Vol. 17, No. 8, 2022.
24	Bennett, C. E., A. Venkataramani, F. M. Henretig, J. Faerber, L. Song, and J. N. Wood, "Recent Trends in Marijuana-Related Hospital Encounters in Young Children," <i>Academic Pediatrics</i> , Vol. 22, No. 4, 2022.
25	Blake, C. D., D. K. Thomas, and J. Hess, "Higher Education: The Impact of Recreational Marijuana on College Applications," <i>Contemporary Economic Policy</i> , Vol. 42, No. 2, 2024.
26	Bleyer, A., B. Barnes, and K. Finn, "United States Marijuana Legalization and Opioid Mortality Trends Before and During the First Year of the COVID-19 Pandemic," <i>Journal of Opioid Management</i> , Vol. 20, No. 2, 2024.
27	Borbely, D., O. Lenhart, J. Norris, and A. Romiti, <i>Marijuana Legalization and Mental Health</i> , IZA Discussion Papers, No. 15729, 2022.
28	Bourdon, J. L., M. W. Francis, L. Jia, C. Liang, H. I. Robinson, and R. A. Grucza, "The Effect of Cannabis Policies on Treatment Outcomes for Cannabis Use Among US adults," <i>Journal of Substance Abuse Treatment</i> , Vol. 131, 2021.
29	Bradford, A. C., F. Lozano-Rojas, H. B. Shone, W. D. Bradford, and A. J. Abraham, "Cannabis Laws and Utilization of Medications for the Treatment of Mental Health Disorders," <i>JAMA Network Open</i> , Vol. 7, No. 9, 2024.
30	Brinkman, J., and D. Mok-Lamme, "Not in my Backyard? Not so Fast. The Effect of Marijuana Legalization on Neighborhood Crime," <i>Regional Science and Urban Economics</i> , Vol. 78, 2019.
31	Britton, E. M., R. Taisir, A. Cooper, Y. Li, S. Sousa, Y. Chorny, J. MacKillop, and M. J. Costello, "Examining the Potential Impact of Recreational Cannabis Legalization on Individuals Receiving Treatment for Substance Use Disorder: An Interrupted Time Series Study in Guelph, Ontario, Canada," <i>Cannabis</i> , Vol. 7, No. 3, 2024.
32	Brushwood, J. D., C. M. Hall, and E. T. Rapley, "Unintended Costs of a Dual Regulatory Environment: Evidence from State-Level Cannabis Legalization and Bank Audit Fees," <i>Journal of Accounting and Public Policy</i> , Vol. 39, No. 3, 2020.
33	Brushwood, J. D., M. A. Draeger, and E. T. Rapley, "Cannabis financial statement audits in Canada before and after legalization: A "joint" analysis," <i>Journal of Accounting and Public Policy</i> , Vol. 42, No. 6, 2023.
34	Bruzelius, E., and S. S. Martins, "Recreational cannabis legalization and immigration enforcement: a state-level analysis of arrests and deportations in the United States, 2009–2020," <i>BMC Public Health</i> , Vol. 24, No. 1, 2024.
35	Buttorff, C., G. S. Wang, A. Wilks, G. Tung, A. Kress, D. Schwam, and R. L. Pacula, "Impact of Recreational Cannabis Legalization on Opioid Prescribing and Opioid-Related Hospital Visits in Colorado: An Observational Study," <i>Journal of General Internal Medicine</i> , 2023.

ID	Study Bibliographic Information
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244	Zambiasi, D., and S. Stillman, "The Pot Rush: Is Legalized Marijuana a Positive Local Amenity?" <i>Economic Inquiry</i> , Vol. 58, No. 2, 2020.

Table 5. Literature Review Study Characteristics for All 244 Studies That Met Inclusion Criteria

Author (Year)	Title	Location	Policy Change	Outcome Category
Abouk, R. et al. (2023)	Pain management and work capacity: Evidence from workers' compensation and marijuana legalization	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions • Other health outcomes • Employment and economics
Adhikari, K. et al. (2023)	Revisiting the effect of recreational marijuana on traffic fatalities	10 U.S. state which had adult-use retail stores (Treated); All other U.S. states (Control)	Adult-use retail sales	• Traffic crashes and mortality
Alcocer, JJ. (2020)	Exploring the effect of Colorado's recreational marijuana policy on opioid overdose rates	CO (Treated); Control states to mimic CO (Control)	Adult-use retail sales (2014)	• Other health outcomes
Alexander, G.D. et al. (2024)	Recreational cannabis legalization: No contribution to rising prescription stimulants in the USA	All 50 states and DC	Adult-use retail sales	• Other substance use
Ali, M.M. et al. (2022)	Recreational marijuana laws and the misuse of prescription opioids: Evidence from National Survey on Drug Use and Health microdata	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions • Other substance use
Alley, Z.M. et al. (2020)	Trends in college students' alcohol, nicotine, prescription opioid and other drug use after recreational marijuana legalization: 2008-2018	48 U.S. states (excludes states because of lack of data or because administration of survey overlapped with adult-use legalization date)	Adult-use legalization	• Other substance use
Anderson, D.M. et al. (2019)	Association of marijuana laws with teen marijuana use: new estimates from the Youth Risk Behavior Surveys	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions
Anderson, D.M. et al. (2021)	Association of marijuana legalization with marijuana use among US high school students, 1993-2019	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions
Anderson, D.M. et al. (2024)	Recreational Marijuana Laws and Teen Marijuana Use, 1993-2021	All 50 states	Adult-use legalization; Adult-use retail sales	• Cannabis use and perceptions
Anderson, K.K. et al. (2024)	Impact of non-medical cannabis legalization with market restrictions	Ontario	Adult-use legalization (2018)	• Other health outcomes

Author (Year)	Title	Location	Policy Change	Outcome Category
	on health service use and incident cases of psychotic disorder in Ontario, Canada			
Armstrong, M.J. et al. (2022)	Interrupted time series analysis of Canadian legal cannabis sales during the COVID-19 pandemic	All 10 provinces and 3 territories	Introduction of extracts, edibles, and topicals to the Canadian legal market (2020)	• Other: Cannabis markets
Armstrong, M (2024)	Canada's recreational cannabis legalization and medical cannabis patient activity, 2017-2022	All 10 provinces	Adult use law passage (June 2018)	• Other: Cannabis markets
Armstrong, M.J. et al. (2024)	Changes in population-level alcohol sales after non-medical cannabis legalization in Canada		Adult-use legalization (2018)	• Other substance use
Aydelotte, J.D. et al. (2019)	Fatal crashes in the 5 years after recreational marijuana legalization in Colorado and Washington	CO, WA (Treated); HI, MT, NM, RI, VT, ID, KS, NE, SD (Control)	Adult-use legalization	• Traffic crashes and mortality
Bae, H. & Kerr, D.C.R. (2019)	Marijuana use trends among college students in states with and without legalization of recreational use: initial and longer-term changes from 2008 to 2018	48 U.S. states (excludes states because of lack of data or because administration of survey overlapped with adult-use legalization date)	Adult-use legalization	• Cannabis use and perceptions
Baggio, M. & Chong, A. (2020)	Recreational marijuana laws and junk food consumption	52 designated market areas in 48 U.S. states	Adult-use legalization	• Other: Food consumption
Baggio, M et al. (2024)	High times and troubled relationships: recreational marijuana laws and intimate partner violence	39 U.S. states	Adult-use legalization	• Crime and social outcomes
Bai, Y. et al. (2025)	The impact of recreational cannabis retailer allocation on emergency department visits: A natural experiment utilizing lottery design	Ontario	Adult-use legalization	• Other health outcomes
Barker, A.K. & Moreno, M.A. (2021)	Effects of recreational marijuana legalization on college students: A longitudinal study of attitudes, intentions and use behaviors	WA (Treated); WI (Control)	Adult-use legalization (2012)	• Cannabis use and perceptions
Bass, B. et al. (2024)	Adult use cannabis legalization and cannabis use disorder treatment in California, 2010-2021	California	Adult-use legalization (2016)	• Other health outcomes

Author (Year)	Title	Location	Policy Change	Outcome Category
Beasley, W.J. & Dundas, S.J. (2024)	Recreational cannabis dispensary access effects on prescription opioid use and mortality	Oregon	Adult-use retail stores	• Other substance use • Other health outcomes
Bednarek, Z. et al. (2022)	U.S. cannabis laws projected to cost generic and brand pharmaceutical firms billions	All 50 states and DC	Adult-use legalization	• Other: Financial outcomes
Bennett, C.E. et al. (2022)	Recent trends in marijuana-related hospital encounters in young children	27 U.S. states and DC	Adult-use legalization	• Other health outcomes
Blake, C.D. et al. (2023)	Higher education: The impact of recreational marijuana on college applications	All 50 states and DC	Adult-use legalization	• Employment and economics • Crime and other social outcomes
Blalthrop, A. et al. (2024)	Marijuana legalization and truck safety	All 50 U.S. states	Adult-use legalization	• Traffic crashes and mortality
Bleyer, A. et al. (2024)	United States marijuana legalization and opioid mortality trends before and during the first year of the COVID-19 pandemic	All 50 states and D.C.	Adult-use legalization	• Other health outcomes
Borbely, D. et al. (2022)	Marijuana legalization and mental health	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions • Other health outcomes
Bourdon, J.L. et al. (2021)	The effect of cannabis policies on treatment outcomes for cannabis use among U.S. adults	All 50 states and DC	Adult-use legalization	• Other substance use • Other health outcomes
Bradford, A.C. et al. (2024)	Cannabis laws and utilization of medications for the treatment of mental health disorders	All 50 states and DC	Adult-use legalization	• Other substance use
Brinkman, J. & Mok-Lamme, D. (2019)	Not in my backyard? Not so fast. The effect of marijuana legalization on neighborhood crime	Denver, CO	Adult-use retail sales (2014)	• Crime and social outcomes
Britton, E.M. et al. (2024)	Examining the Potential Impact of Recreational Cannabis Legalization on Individuals Receiving Treatment for Substance Use Disorder: An Interrupted Time Series Study in Guelph, Ontario, Canada	Guelph, Ontario	Adult-use legalization (Phase I); Adult-use legalization (Phase II)	• Cannabis and use perceptions • Other substance use

Author (Year)	Title	Location	Policy Change	Outcome Category
Brushwood, J.D. et al. (2020)	Unintended costs of a dual regulatory environment: Evidence from state-level cannabis legalization and bank audit fees	AK, CO, OR, WA (Treated); All other U.S. states (Control); Note: CA, MA, ME, NV are excluded.	Adult-use retail sales	• Other: Financial outcomes
Brushwood, J.D. et al. (2023)	Cannabis financial statement audits in Canada before and after legalization: A "joint" analysis	Canada	Adult-use legalization (2018)	• Other: Financial outcomes
Bruzelius, E & Martins, S.S. (2024)	Recreational cannabis legalization and immigration enforcement: a state-level analysis of arrests and deportations in the United States, 2009-2020	38 U.S. states	Adult-use legalization	• Crime and social outcomes
Buttorf, C. et al. (2023)	Impact of recreational cannabis legalization on opioid prescribing and opioid-related hospital visits in Colorado: an observational study	Colorado	Adult-use retail sales (2014)	• Other substance use • Other health outcomes
Calcaterra, S.L. et al. (2019)	Changes in healthcare encounter rates possibly related to cannabis or alcohol following legalization of recreational marijuana in a safety-net hospital: An interrupted time series analysis	Denver, CO	Adult-use retail sales (2014)	• Other health outcomes
Callaghan, R.C. et al. (2021)	Canada's cannabis legalization and drivers' traffic-injury presentations to emergency departments in Ontario and Alberta, 2015-2019	Ontario, Alberta	Adult-use legalization (2018)	• Traffic crashes and mortality
Callaghan, R.C. et al. (2021)	Impacts of Canada's cannabis legalization on police-reported crime among youth: early evidence	All 10 provinces and 3 territories	Adult-use legalization (2018)	• Crime and social outcomes
Callaghan, R.C. et al. (2022)	Associations between Canada's cannabis legalization and emergency department presentations for transient cannabis-induced psychosis and schizophrenia conditions: Ontario and Alberta, 2015-2019	Ontario, Alberta	Adult-use legalization (2018)	• Other health outcomes
Callaghan, R.C. et al. (2023)	Impact of Canada's cannabis legalisation on youth emergency department visits for cannabis-related	Ontario, Alberta	Adult-use legalization (2018)	• Other health outcomes

Author (Year)	Title	Location	Policy Change	Outcome Category
	disorders and poisoning in Ontario and Alberta, 2015-2019			
Callaghan, R.C. et al. (2023)	Canada's cannabis legalization and adult crime patterns, 2015-2021: A time series study	All 10 provinces and 3 territories of Canada	Adult-use legalization (2018)	• Crime and social outcomes
Callaghan, R.C. et al. (2024)	Canada's cannabis legalization and police-reported cannabis-related criminal incidents among youth, 2015-2021	Canada	Adult-use legalization (Cannabis Act)	• Crime and social outcomes
Calvert, C. & Erickson, D. (2020)	An examination of relationships between cannabis legalization and fatal motor vehicle and pedestrian-involved crashes	CO, WA, OR (Treated); AR, WI, IN, IA, KY (Control)	Adult-use legalization	• Traffic crashes and mortality
Calvert, C.M. & Erickson, D. (2021)	Recreational cannabis legalization and alcohol purchasing: a difference-in-difference analysis	CO, WA, OR (Treated); NJ, TX, VA, NC, IL, WV (Control) ; Or all non-legalized states (Control)	Adult use legalization	• Other substance use
Castillo-Carniglia, A. et al. (2023)	Changes in opioid and benzodiazepine poisoning deaths after cannabis legalization in the US: A county-level analysis, 2002-2020	49 U.S. states (not including DC or AK)	Adult-use legalization	• Other health outcomes
Cerda et al. (2020)	Association between recreation marijuana legalization in the United States and changes in marijuana use and cannabis use disorder from 2008 to 2016	CO, WA, AK, OR (Treated) ; All other U.S. states (Control)	Adult-use legalization	• Cannabis use and perceptions
Cerda, M. et al. (2024)	The role of prescription opioid and cannabis supply policies on opioid overdose deaths	All 50 states and DC	Adult-use legalization / Adult-use retail stores	• Other health outcomes
Chakraborty, A. et al (2021)	The effects of recreational cannabis access on labor markets: evidence from Colorado	CO	Adult-use retail sales	• Employment and economics
Chamlin, M.B. (2020)	An examination of the unintended consequences of the legalization of recreational marijuana on alcohol-related behaviors	CO	Adult-use retail sales (2014)	• Other substance use

Author (Year)	Title	Location	Policy Change	Outcome Category
Chan et al. (2019)	The effects of recreational marijuana legalization and dispensing on opioid mortality	A subsample of states that excludes states with a pronounced growth in synthetic opioid mortality rates. The dropped states are: CT, DC, DE, FL, IL, IN, KY, MA, MD, ME, MI, MO, NC, NH, NJ, NY, OH, PA, RI, TN, VA, VT, and WV.	Adult-use legalization	• Other substance use • Other health outcomes
Chen, W. & French, M.T. (2023)	Marijuana legalization and traffic fatalities revisited	All 50 states and DC	Adult-use legalization	• Traffic crashes and mortality
Cil, G. et al. (2023)	Legalization and retail availability of recreational marijuana and adolescent use in schools	Middle and high schools in OR (Treated) ; CT, IL, MT, NY (Control)	Adult-use legalization (2015)	• Other: School disciplinary actions
Coley, R.L. et al. (2021)	Recreational marijuana legalization and adolescent use of marijuana, tobacco, and alcohol	47 U.S. states	Adult-use legalization	• Cannabis use and perceptions • Other substance use
Coley, R.L. et al. (2024)	Recreational cannabis legalization, retail sales, and adolescent substance use through 2021	47 U.S. states	Adult-use legalization	• Cannabis use and perceptions • Other substance use
Connealy, N. et al. (2019)	The criminogenic effect of marijuana dispensaries in Denver, Colorado: A microsynthetic control quasi-experiment and cost-benefit analysis	Denver, CO	Adult-use retail sales (2014)	• Crime and social outcomes
Dave, D. et al. (2023)	Have recreational marijuana laws undermined public health progress on adult tobacco use?	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions • Other substance use
Dave, D.M., et al. (2025)	The effects of recreational marijuana legalization on employment and earnings	All 50 states and DC	Adult-use legalization; Sensitivity: Adult-use retail sales, Border state adult-use policy	• Cannabis use and perceptions • Employment and economics
de Assis, B. (2025)	The Cross-Border Spillover Effects of Cannabis Regulation in South America	Municipality	ACL in Uruguay	• Crime and social outcomes
De, P.K. & Sun, R. (2025)	The effects of recreational cannabis laws on alcohol and tobacco use among U.S. adults, 2012-2022	All 50 states and DC	Adult-use legalization; Adult-use retail sales	• Other substance use

Author (Year)	Title	Location	Policy Change	Outcome Category
Delling, F.N. et al. (2019)	Does cannabis legalization change healthcare utilisation? A population-based study using the healthcare cost and utilisation project in Colorado, USA	CO (Treated); NY, OK (Control)	Adult-use legalization (2012)	• Other health outcomes
Denkyirah, E.K. et al. (2025)	Recreational marijuana legalization's impact and opioid death rates: A synthetic control approach	CO, WA, OR and synthetically constructed counterfactual states	Adult-use retail sales (2014)	• Other health outcomes
Dewey, J. et al. (2021)	State marijuana laws and traffic fatalities	All 50 states and DC	Adult-use legalization	• Traffic crashes and mortality
Dewey, J. & Vadlamani, S. (2023)	Marijuana laws and pedestrian fatalities in the United States	All 50 states and DC	Adult-use legalization	• Traffic crashes and mortality
Dong, X. (2021)	Recreational marijuana sales legalization and Monday work injury claims	Oregon	Adult-use retail sales (2015)	• Employment and economics
Dong, X. & Tyndall, J. (2023)	The impact of recreational marijuana dispensaries on crime: evidence from a lottery experiment	Three cities in WA (Seattle, Spokane and Tacoma)	Adult-use retail sales (2014)	• Crime and social outcomes
Doremus, J.M. et al. (2019)	Using recreational cannabis to treat insomnia: Evidence from over-the-counter sleep aid sales in Colorado	Colorado	Adult-use retail sales	• Other: Sleep
Doucette, M.L. et al. (2021)	Effect of Washington State and Colorado's cannabis legalization on death by suicides	WA, CO (Treated); A pool of U.S. states that had not legalized adult-use cannabis (Control)	Adult-use retail sales (2014)	• Other health outcomes
Dragone, D. et al. (2019)	Crime and the legalization of recreational marijuana	WA (Treated), OR (Control)	Adult-use legalization (WA=2012, OR=2014)	• Crime and social outcomes
Drake, C. et al. (2021)	Recreational cannabis laws and opioid-related emergency department visit rates	29 U.S. states	Adult-use legalization (Q1 2017)	• Other health outcomes
Dranitaris, G. et al. (2021)	Opioid prescribing in Canada following the legalization of cannabis: A clinical and economic time-series analysis	All 10 provinces	Adult-use legalization (2018)	• Other substance use

Author (Year)	Title	Location	Policy Change	Outcome Category
El Fatmaoui, A. (2024)	From high school to higher education: Is recreational marijuana a consumption amenity for US college students?	All US states except DC, Alaska, Maine, Michigan, and Hawaii	Adult-use legalization	• Employment and economics
Elser, H. et al. (2023)	State cannabis legalization and psychosis-related health care utilization	All 50 states and DC	Adult-use legalization	• Other health outcomes
Everson, E.M. et al. (2019)	Post-legalization opening of retail cannabis stores and adult cannabis use in Washington State, 2009-16	WA	Adult-use legalization (2012)	• Cannabis use and perceptions
Farmer et al. (2022)	Changes in traffic crash rates after legalization of marijuana: results by crash severity	CO, WA, OR, CA, NV (Treated); AZ, ID, MT, NM, UT, WY (Control)	Adult-use legalization; Adult-use retail sales	• Traffic crashes and mortality
Fink, D.S. et al. (2025)	Cannabis legalization and increasing cannabis use in the United States: Data from urine toxicology testing in emergency room patients	All 50 states and DC	Adult-use legalization	• Other health outcomes
Firth, C.L. et al. (2020)	Implications of cannabis legalization on juvenile justice outcomes and racial disparities	OR	Adult-use legalization	• Crime and social outcomes
Gardner, J. & Osei, B. (2022)	Recreational marijuana legalization and admission to the foster-care system	All 50 states and DC	Adult-use legalization	• Other: Foster care
Goncalves, P.D. et al. (2022)	Cannabis recreational legalization and prevalence of simultaneous cannabis and alcohol use in the United States	All 50 states and DC	Adult-use retail sales or adult-use home cultivation	• Cannabis use and perceptions • Other substance use
Goncalves, P.D. et al. (2023)	Recreational cannabis legislation and binge drinking in U.S. adolescents and adults	All 50 states and DC	Adult-use retail stores or home cultivation (whichever comes first)	• Other substance use
Goodman, S. & Hammond, D. (2021)	Noticing of cannabis health warning labels in Canada and the U.S.	All 10 provinces; U.S. states that had legalized adult-use cannabis (including DC); U.S. states that had not legalized adult-use cannabis	Adult-use legalization (2018)	• Cannabis use and perceptions
Goodman, S. & Hammond, D. (2022)	Perceptions of the health risks of cannabis: estimates from national	All 10 provinces; U.S. states that had legalized adult-use	Adult-use legalization (2018)	• Cannabis use and perceptions

Author (Year)	Title	Location	Policy Change	Outcome Category
	surveys in Canada and the United States, 2018-2019	cannabis (including DC); U.S. states that had not legalized adult-use cannabis		
Goodman, S. et al. (2022)	Do mandatory health warning labels on consumer products increase recall of the health risks of cannabis?	All 10 provinces; U.S. states that had legalized adult-use cannabis (including DC); U.S. states that had not legalized adult-use cannabis	Adult-use legalization (2018)	• Cannabis use and perceptions
Goodwin, R.D. et al. (2021)	Trends in cannabis use among adults with children in the home in the United States, 2004-2017: impact of state-level legalization for recreational and medical use	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions
Goodwin, R.D. et al. (2023)	Cannabis legalization and childhood asthma in the United States: An ecologic analysis	All 50 states and DC	Adult-use legalization	• Other health outcomes
Grafft, N. et al. (2023)	Recreational cannabis legalization and adolescent sexual risk behaviors	41 U.S. states	Adult-use legalization	• Other: Risky sex
Grant, A. et al. (2025)	Do medical and recreational marijuana state laws impact trends in postoperative opioid prescriptions among patients who have undergone TJA?	All 50 states and DC	Adult-use legalization	• Other substance use
Gunadi, C. (2022)	Does expanding access to cannabis affect traffic crashes? County-level evidence from recreational marijuana dispensary sales in Colorado	CO	Adult-use retail sales (2014)	• Other health outcomes • Traffic crashes and mortality
Gunadi, C. & Shi, Y. (2022)	Association of recreational cannabis legalization with cannabis possession arrest rates in the U.S.	31 U.S. states that had either adult-use cannabis laws or had decriminalized cannabis	Adult-use legalization	• Crime and social outcomes
Gunadi, C. et al. (2022)	Recreational cannabis legalization and transitions in cannabis use: findings from a nationally representative longitudinal cohort in the United States	All U.S. states except those that had legalized adult-use cannabis prior to study period or legalized medical cannabis in between study period	Adult-use legalization	• Cannabis use and perceptions
Hammond, C.J. et al. (2023)	Association between marijuana laws and suicide among 12- to 25-year-	All 50 states and DC	Adult-use legalization	• Other health outcomes

Author (Year)	Title	Location	Policy Change	Outcome Category
	olds in the United States from 2000 to 2019			
Hansen, B. et al. (2018)	Early evidence on recreational marijuana legalization and traffic fatalities	CO (Treated); Donor pool of U.S. states that have similar trajectories as CO (Control)	Adult-use retail sales (2014)	• Traffic crashes and mortality
Hansen, B. et al. (2020)	Federalism, partial prohibition, and cross-border sales: Evidence from recreational marijuana	WA	Adult-use retail sales (2015)	• Other: Cannabis markets
Hao, Z. & Cowan, B.W. (2019)	The cross-border spillover effects of recreational marijuana legalization	Border counties (Treated) and non-border counties (Control) in WY, UT, NM, OK, KS, NE ; Border counties(Treated) and non-border counties (Control) in ID, OR	Adult-use legalization (2012)	• Crime and social outcomes
Harper, A.J. & Jorgensen, C. (2022)	Crime in a time of cannabis: Estimating the effect of legalizing marijuana on crime rates in Colorado and Washington using the synthetic control method	CO, WA (Treated); Donor pool of 40 states without adult-use cannabis (Control)	Adult-use legalization	• Crime and social outcomes
Harris, K.N. & Kulesza, C. (2023)	Exploring the impact of adult-use cannabis legalization on legal system referrals to treatment for cannabis use: do age and race have a moderating effect?	43 U.S. states; (data on 7 states were excluded because of data limitations)	Adult-use legalization	• Other health outcomes
Hasin, D.S. et al. (2023)	Chronic pain, cannabis legalisation, and cannabis use disorder among patients in the US Veterans Health Administration system, 2005 to 2019: a repeated, cross-sectional study	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions
Hasin, D.S. et al. (2023)	State cannabis legalization and cannabis use disorder in the U.S. veterans health administration, 2005 to 2019	All 50 states and DC	Adult-use legalization	• Other health outcomes
Hathaway, A.D. et al. (2021)	How well is cannabis legalization curtailing the illegal market? A multiwave analysis of Canada's National Cannabis Survey	All 10 provinces	Adult-use legalization (2018)	• Other: Cannabis markets

Author (Year)	Title	Location	Policy Change	Outcome Category
Hobin, E. et al. (2023)	Co-use of cannabis and alcohol before and after Canada legalized nonmedical cannabis: A repeat cross-sectional study	All 10 provinces; U.S. states that had legalized adult-use cannabis (including DC); U.S. states that had not legalized adult-use cannabis	Adult-use legalization (2018)	• Cannabis use and perceptions • Other substance use
Hodge, T.R. & Hazel, C. (2022)	The munchies: Marijuana legalization and food sales in Washington	WA	Adult-use retail sales (2014)	• Other: Food consumption
Hollingsworth, A. et al. (2022)	Comparative effects of recreational and medical marijuana laws on drug use among adults and adolescents	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions • Other substance use • Crime and social outcomes
Horak, B. & Frei, C. (2023)	Cannabis legalization: do banking transactions reflect a shift away from the illegal market?	Alberta	Adult-use legalization (2018)	• Other: Cannabis markets
Hsu, G. & Kovacs, B. (2021)	Association between county level cannabis dispensary counts and opioid related mortality rates in the United States: panel data study	23 U.S. states that allowed adult-use or medical retail stores ; (Suppl. Analyses uses all U.S. states)	Adult-use retail stores	• Other health outcomes
Hughes, L.A. et al. (2020)	Marijuana dispensaries and neighborhood crime and disorder in Denver, Colorado	Denver, CO	Adult-use retail stores (2014)	• Crime and social outcomes
Jameson, M. et al. (2023)	Out of the shadows: the behavior of the market for cannabis during its transition to legal status	48 U.S. states (excludes AK and HI)	Adult-use legalization (2012)	• Other: Cannabis markets
Jayawardhana, J. & Fernandez, J. (2024)	Impact of medical and recreational cannabis laws on inpatient visits for asthma	38 U.S. states	Adult-use legalization	• Other health outcomes
Jayawardhana, J. et al. (2024)	Association of State Cannabis Legalization with Cannabis Use Disorder and Cannabis Poisoning	All 50 states and D.C.	Adult-use legalization	• Cannabis use and perceptions • Other health outcomes
Jiang, S. & Miller, K. (2022)	Watching the grass grow: does recreational cannabis legalization affect retail and agricultural wages?	CO, WA (Treated); Donor pool of states excluding states that had legalized adult-use cannabis and those that are adjacent to the treated states to avoid spillover effects (Control)	Adult-use legalization (2012)	• Employment and economics

Author (Year)	Title	Location	Policy Change	Outcome Category
Jorgensen, C. & Harper, A.J. (2020)	Examining the effects of legalizing marijuana in Colorado and Washington on clearance rates: a quasi-experimental design	CO, WA (Treated); Donor pool of 39 states excluding states that had legalized adult use cannabis after 2013 and states with missing data (FL, HI, IL)	Adult-use legalization (2012)	• Crime and social outcomes
Kamer, R.S. et al. (2020)	Change in traffic fatality rates in the first 4 states to legalize recreational marijuana	CO, WA, OR, AK (Treated); 20 states that did not legalize adult-use or medical cannabis as of 2018 (Control)	Adult-use retail sales	• Traffic crashes and mortality
Kerr, D.C.R. et al. (2018)	Oregon recreational marijuana legalization: Changes in undergraduates' marijuana use rates from 2008 to 2016	Oregon and U.S. states without adult-use cannabis laws (exact states unknown)	Adult-use legalization (2014)	• Cannabis use and perceptions
Kerr, D.C.R. et al. (2023)	Cannabis and alcohol use by U.S. young adults, 2008-2019: changes in prevalence after recreational cannabis legalization	All 50 states and DC	Adult-use legalization and home cultivation	• Cannabis use and perceptions • Other substance use
Kilmer, B. et al. (2022)	Cannabis legalization and traffic injuries: exploring the role of supply mechanisms	19 Departments of Uruguay	Supply of adult-use cannabis: home cultivation, pharmacies (members), purchases)	• Traffic crashes and mortality
Kim, J.H. et al. (2021)	Impact of state-level cannabis legalization on poly use of alcohol and cannabis in the United States, 2004-2017	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions • Other substance use
Kim, C. et al. (2022)	Associations between recreational cannabis legalization and cannabis-related emergency department visits by age, gender, and geographic status in Ontario, Canada: An interrupted time series study	Ontario, Canada	Adult-use legalization (Phase 1 - 2018; Phase 2 - 2019)	• Other health outcomes
Kim, C. et al. (2023)	Disparities in cannabis-related emergency department visits across depressed and non-depressed individuals and the impact of recreational cannabis policy in Ontario, Canada	Ontario, Canada	Adult-use legalization; Phase 1: Dried flower and some oils (Oct 2018)	• Other health outcomes

Author (Year)	Title	Location	Policy Change	Outcome Category
Kim, C. et al. (2024)	Cannabis legalization and hospitalizations in Alberta: Interrupted time series analysis by age and sex	Alberta, Canada	Adult-use legalization (Phase 1 - 2018)	• Other health outcomes
Kim, C. et al. (2024)	The impact of recreational cannabis legalization on cannabis-related acute care events among adults with schizophrenia	Ontario, Canada	Adult-use legalization (Phase I); Adult-use legalization (Phase II)	• Other health outcomes
Klein, T.A. et al. (2022)	Synthetic cannabinoid poisonings and access to the legal cannabis market: findings from US national poison centre data 2016-2019	All 50 states and DC	Adult-use legalization	• Other health outcomes
Lane, T.J. & Hall, W. (2019)	Traffic fatalities within US states that have legalized recreational cannabis sales and their neighbours	CO, WA, OR (Treated - legal); KS, NE, NM, OK, UT (Treated CO neighbor); BC, OR (Treated WA neighbor); CA, NV (Treated OR neighbor); U.S. states that had not legalized medical cannabis, adult-use cannabis or sales during the study period (Control).	Adult-use retail sales	• Traffic crashes and mortality
Laqueur, H. et al. (2020)	The impact of cannabis legalization in Uruguay on adolescent cannabis use	Montevideo and regions in the interior of Uruguay (Treated); Weighted combination of 15 regions in Chile (Control)	Adult-use legalization	• Cannabis use and perceptions
Lara, L.F. et al. (2022)	Acute and severe acute pancreatitis and the effect of cannabis in states before and after legalization compared to states without legalized cannabis	CO, WA (Treated); AZ, FL (Control)	Adult-use retail sales	• Other health outcomes
Lee, M.H. et al. (2022)	Adolescents' marijuana use following recreational marijuana legalization in Alaska and Hawaii	AK (Treated); HI (Control)	Adult-use retail sales	• Cannabis use and perceptions
Lee, S. (2024)	The effects of recreational cannabis legalization on recidivism	40 U.S. states (CO, ME, MA, NV, WA and 35 states that did not legalize adult-use cannabis)	Adult-use legalization	• Crime and social outcomes

Author (Year)	Title	Location	Policy Change	Outcome Category
Li, L. et al. (2024)	Recreational marijuana legalization and workplace injuries among younger workers	All 50 U.S. states	Adult-use legalization	• Employment and economics
Liu, Y. et al. (2025)	Recreational Cannabis Legalization and Illicit Drugs: Drug Usage, Mortality, and Darknet Transactions	All 50 states and DC	Adult-use legalization	• Other substance use
Lockwood, J. et al. (2019)	The association between the legalization of recreational marijuana and both small for gestational age births and NICU admissions in Colorado	CO	Adult-use retail sales (2014)	• Other health outcomes
Lu, R. et al. (2021)	The cannabis effect on crime: Time-series analysis of crime in Colorado and Washington State	CO, WA (Treated); 21 states that have not legalized adult-use or medical cannabis	Adult-use legalization (2012)	• Crime and social outcomes
Lu, T. et al. (2021)	Marijuana legalization and household spending on food and alcohol	All 50 states and DC	Adult-use legalization	• Other: Food consumption
Macha, V. et al. (2022)	Association of Recreational Cannabis Legalization with Alcohol Use among Adults in the US, 2010 to 2019	All 50 states and DC	Adult-use legalization	• Other substance use
Maclean, J.C. et al. (2021)	Marijuana legalization and disability claiming	All 50 states and DC	Adult-use legalization	• Employment and economics
Makin, D.A. et al. (2019)	Marijuana legalization and crime clearance rates: testing proponent assertions in Colorado and Washington State	CO	Adult-use legalization (2012)	• Crime and social outcomes
Makin, D.A. et al. (2021)	The impact of recreational marijuana sales on calls for service: an analysis of neighbouring cities	Pullman, WA, and Moscow, ID	Adult-use retail sales (2014)	• Crime and social outcomes
March, R.J. et al. (2022)	Cloudy with a chance of munchies: Assessing the impact of recreational marijuana legalization on obesity	WA (Treated); Donor pool of 11 U.S. states with similar obesity results (Control)	Adult-use retail sales (2014)	• Other: Obesity
Marinello, S. & Powell, L.M. (2023)	The impact of recreational cannabis markets on motor vehicle accident, suicide, and opioid overdose fatalities	CO, WA, OR, AK, NV, CA, MA	Adult-use retail sales	• Other health outcomes • Traffic crashes and mortality
Marinello, S. (2025)	The impact of recreational cannabis markets on cannabis use among	CO, WA, OR, AK, NV and a pooled synthetic control group	Adult-use retail sales	• Cannabis use and perceptions

Author (Year)	Title	Location	Policy Change	Outcome Category
	adolescents and adults: a synthetic control analysis	of states that had comprehensive medical cannabis laws but did not implement adult-use cannabis during the study period		
Martinez, P. et al. (2024)	Changes in the incidence of cannabis-related disorders after the Cannabis Act and the COVID-19 pandemic in Quebec, Canada	Quebec	Adult-use legalization (2018)	• Other health outcomes
Martins, S.S. et al (2021)	Racial and ethnic differences in cannabis use following legalization in US states with medical cannabis laws	Study focused on U.S. states with medical cannabis laws but used all 50 states in analyses	Adult-use legalization	• Cannabis use and perceptions
Martins, S.S. et al. (2025)	The relationship of medical and recreational cannabis laws with opioid misuse and opioid use disorder in the USA: Does it depend on prior history of cannabis use?	All 50 states	Adult-use legalization	• Other substance use • Other health outcomes
Masonbrink, A.R. et al. (2021)	Trends in adolescent cannabis-related hospitalizations by state legalization laws, 2008-2019	18 U.S. states plus DC	Adult-use legalization	• Other health outcomes
Mathur, N.K. & Ruhm, C.J. (2023)	Marijuana legalization and opioid deaths	All 50 states and DC	Adult-use legalization	• Other substance use
Matthay, E.C. et al (2021)	Evaluation of state cannabis laws and rates of self-harm and assault	All 50 states and DC	Adult-use legalization	• Other health outcomes
Matthay, E.C. et al (2024)	Associations of Local Cannabis Control Policies With Harmful Cannabis Exposures Reported to the California Poison Control System	California	Adult-use retail sales (2018)	• Other health outcomes
Mauro, P.M. et al. (2024)	Associations between cannabis policies and state-level specialty cannabis use disorder treatment in the United States, 2004-2019	All 50 U.S. states and DC	Adult-use legalization	• Other health outcomes
McCarthy, S.D.S. et al. (2024)	Changes in cannabis involvement in emergency department visits for anxiety disorders after cannabis	Ontario	Adult-use legalization (Phase I); Adult-use legalization (Phase II)	• Other health outcomes

Author (Year)	Title	Location	Policy Change	Outcome Category
	legalization: a repeated cross-sectional study			
McDonald, A.J. et al. (2024)	Legal Recreational Cannabis Sales and Opioid-Related Mortality in the 5 Years Following Cannabis Legalization in Canada: A Granger Causality Analysis	National, Ontario, British Columbia	Adult-use legalization	• Other health outcomes
McDonald, A.J. et al. (2025)	Association of recreational cannabis legalization with changes in medical, illegal, and total cannabis expenditures in Canada	All 10 provinces and 3 territories	Adult-use legalization (passage - 2017)	• Other: Cannabis markets
McMichael, B.J. et al. (2020)	The impact of cannabis access laws on opioid prescribing	All 50 states and DC	Adult-use legalization	• Other substance use
Meehan, B. et al. (2020)	(Pot)Heads in Beds: The effect of marijuana legalization on hotel occupancy in Colorado and Washington	CO, WA (Treated); 46 other contiguous states	Adult-use legalization (2012)	• Employment and economics
Meier, M.H. et al. (2023)	The effects of the 4/20 cannabis holiday and adult-use cannabis legalization on medical cannabis sales and medical cannabis patient registration in Arizona	AZ	Adult-use legalization (2020)	• Other: Cannabis markets
Meinhofer, A. et al. (2021)	Marijuana liberalization policies and perinatal health	34 U.S. states with HCUP data (includes 9 adult-use states)	Adult-use legalization	• Other health outcomes
Meinhofer, A. & Rubli, A. (2021)	Illegal drug market responses to state recreational cannabis laws	All 50 states and DC	Adult-use legalization	• Other: Illegal markets
Meize, M.R. et al. (2022)	The intersection of gender, race, and arrest in the era of cannabis legalization	CO	Adult-use legalization (2012)	• Crime and social outcomes
Mennis, J. & Stahler, G.J. (2020)	Adolescent treatment admissions for marijuana following recreational legalization in Colorado and Washington	CO, WA (Treated); 41 U.S. states (Control) excluding states that legalized adult-use cannabis before 2017 and those with missing data	Adult-use legalization (2012)	• Other health outcomes
Mennis, J. et al. (2021)	Treatment admissions for opioids, cocaine, and methamphetamines	CO, WA (Treated); 39 U.S. states (Control) excludes	Adult-use legalization (2012)	• Other health outcomes

Author (Year)	Title	Location	Policy Change	Outcome Category
	among adolescents and emerging adults after legalization of recreational marijuana	states that legalized adult-use cannabis before 2017 and those with missing data		
Mennis, J. et al. (2023a)	Recreational cannabis legalization alters associations among cannabis use, perception of risk, and cannabis use disorder treatment for adolescents and young adults	All 50 states	Adult-use legalization	• Cannabis use and perceptions • Other health outcomes
Mennis, J. et al. (2023b)	Young adult depression and cannabis use: associations before and after recreational legalization	All 50 states	Adult-use legalization	• Other health outcomes
Mennis, J. et al. (2023c)	Criminal justice referrals to cannabis use disorder treatment among adolescents and young adults following recreational cannabis legalization in the United States	All 50 states	Adult-use legalization	• Other health outcomes
Mennis, J. et al. (2024)	Why are adolescent cannabis use disorder treatment admissions declining in the US? The mediated pathway of state treatment admissions rates before and after recreational cannabis legalization	All 50 U.S. states	Adult-use legalization	• Other health outcomes
Merrill, R.M. et al. (2024)	Association between cannabis use and physical activity in the United States based on legalization and health status	20 U.S. states	Adult-use legalization	• Other health outcomes
Miller, K. & Seo, B. (2021)	The effect of cannabis legalization on substance demand and tax revenues	WA	Adult-use retail sales (2014)	• Other substance use
Mital, S. et al. (2024)	Association between non-medical cannabis legalization and alcohol sales: Quasi-experimental evidence from Canada	All 10 provinces	Adult-use legalization (2018)	• Other substance use
Montgomery, B.W. et al. (2022)	Estimating the effects of legalizing recreational cannabis on newly incident cannabis use	All 50 states and DC	Adult-use retail sales	• Cannabis use and perceptions
Myran, D.T. et al, (2022a)	Changes in emergency department visits for cannabis hyperemesis	Ontario	Adult-use legalization (phase 1 - 2018)	• Other health outcomes

Author (Year)	Title	Location	Policy Change	Outcome Category
	syndrome following recreational cannabis legalization and subsequent commercialization in Ontario, Canada			
Myran, D.T. et al. (2022b)	The association between recreational cannabis legalization, commercialization and cannabis-attributable emergency department visits in Ontario, Canada: an interrupted time-series analysis	Ontario	Adult-use legalization (phase 1 - 2018)	• Other health outcomes
Myran, D.T. et al. (2023a)	Pediatric hospitalizations for unintentional cannabis poisonings and all-cause poisonings associated with edible cannabis product legalization and sales in Canada	Ontario, Alberta, British Columbia, Quebec	Adult-use legalization (Phase 1 - 2018)	• Other health outcomes
Myran, D.T. et al. (2023b)	Changes in cannabis-attributable hospitalizations following nonmedical cannabis legalization in Canada	Ontario, Quebec, Alberta and British Columbia	Adult-use legalization; Phase 1: Dried flower and some oils (Oct 2018)	• Other health outcomes
Myran, D.T. et al. (2023c)	Cannabis-involved traffic injury emergency department visits after cannabis legalization and commercialization	Ontario	Adult-use legalization; Phase 1: Dried flower and some oils (Oct 2018)	• Other health outcomes
Myran, D.T. et al. (2023d)	Acute care related to cannabis use during pregnancy after the legalization of nonmedical cannabis in Ontario	Ontario	Adult-use legalization (2018)	• Other health outcomes
Myran, D.T. et al. (2023e)	Association between non-medical cannabis legalization and emergency department visits for cannabis-induced psychosis	Ontario	Adult-use legalization; Phase 1: Dried flower and some oils (Oct 2018)	• Other health outcomes
Myran, D.T. et al. (2024)	Cannabis-involvement in emergency department visits for self-harm following medical and non-medical cannabis legalization	Ontario	Adult-use legalization (2018)	• Other health outcomes
Myran, D.T. et al. (2025)	Changes in incident schizophrenia diagnoses associated with cannabis use disorder after cannabis legalization	Ontario	Adult-use legalization	• Other health outcomes

Author (Year)	Title	Location	Policy Change	Outcome Category
Nayeem, N. et al. (2025)	Recreational marijuana laws and suicide deaths in the US	All 50 states and DC	Adult-use legalization	• Other health outcomes
Nazif-Munoz, J.I. et al. (2020)	The association between legalization of cannabis use and traffic deaths in Uruguay	Uruguay, Montevideo and four rural provinces	Adult-use legalization (2013)	• Traffic crashes and mortality
Nazif-Munoz, J.I. et al. (2023)	Did the cannabis recreational use law affect traffic crash outcomes in Toronto? Building evidence for the adequate number of authorised cannabis stores' thresholds	Toronto, Ontario	Adult-use legalization (2018)	• Traffic crashes and mortality
Nazif-Munoz, J.I. et al. (2024)	Changes in prenatal cannabis-related diagnosed disorders after the Cannabis Act and the COVID-19 pandemic in Quebec, Canada	Quebec	Adult-use legalization	• Other health outcomes
Nemer, L. et al. (2021)	Impact of recreational cannabis legalization on hospitalizations for hyperemesis	CO, WA (Treated); AZ, FL (Control)	Adult-use legalization (2012)	• Other health outcomes
Nguyen, H.V. & Mital, S. (2022)	Changes in youth cannabis use after an increase in cannabis minimum legal age in Quebec, Canada	Quebec (Treated); All other provinces (Control)	Increase in MLA; This is technically the reverse of provincial legalization for those aged 18-20	• Cannabis use and perceptions
Nguyen, H.V. et al. (2023)	Short-term effects of recreational cannabis legalization on youth cannabis initiation	All 10 provinces	Adult-use legalization (2018)	• Cannabis use and perceptions
Nguyen, H.V. et al. (2023)	Changes in medical cannabis use after recreational cannabis legalization in Canada	All 10 provinces	Adult-use legalization (2018)	• Other: Cannabis markets
Nguyen, H.V. et al. (2024)	Recreational and medical cannabis legalization and opioid prescriptions and mortality	All 50 states and DC	Adult-use legalization	• Other substance use • Other health outcomes
Noureldin, M. et al. (2024)	Legalization of cannabis does not reduce opioid prescribing in patients with Inflammatory Bowel Disease: a difference-in-difference analysis	CO, WA, ID, WY, SD, NE, KS, TX, IA, WI, IN, KY, TN, MS, AL, GA, SC, NC, VA	Adult-use legalization	• Other substance use
O'Hara, S.E. et al. (2023)	Recreational marijuana legalization, local retail availability, and alcohol	California	Adult-use legalization (2018)	• Cannabis use and perceptions • Other substance use

Author (Year)	Title	Location	Policy Change	Outcome Category
	and marijuana use and co-use among California high school students			
Okey, S.A. et al. (2022)	Are recreational cannabis laws associated with declining medical cannabis program enrollment in the U.S.? An analysis of cardholder enrollment and demographic characteristics from 2013 to 2020	23 U.S. states with medical cannabis laws (and usable data)	Adult-use legalization	• Other: Cannabis markets
Orsini, M.M. et al. (2023)	Adolescent Cannabis Use During a Period of Rapid Policy Change: Evidence from the PATH Study	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions
Orsini, M.M. et al. (2024)	Cannabis policy liberalization is only associated with increased blunt use if states lack strong tobacco control	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions
Ortego, A. (2023)	The highs and the lows: Recreational marijuana laws and mental health treatment	All 50 states	Adult-use legalization	• Other health outcomes
Pearson, J.L. et al. (2024)	Increasing lifetime and past 30-day marijuana use among middle school students regardless of recreational marijuana sales	Nevada, New Mexico	Adult-use retail sales (2017)	• Cannabis use and perceptions
Penney, S.R. et al (2024)	Clinical and public safety risks associated with cannabis legalization and frequency of cannabis use among forensic mental health patients	Ontario	Adult-use legalization	• Cannabis use and perceptions
Perrault-Sequeria, L. et al. (2025)	Cannabis involvement in posttraumatic stress disorder emergency department visits after cannabis legalization	Ontario	Adult-use legalization (2018)	• Other health outcomes
Peters, T. & Foust, C. (2019)	High school student cannabis use and perceptions towards cannabis in southcentral Colorado - comparing communities that permit recreational dispensaries and communities that do not	Southcentral CO	Adult-use retail sales (2014)	• Cannabis use and perceptions

Author (Year)	Title	Location	Policy Change	Outcome Category
Plakias, Z. et al. (2021)	On the money: characterizing banking and lending in the California cannabis industry	CA	Adult-use retail sales (2018)	• Other: Financial outcomes
Plunk, A.D. et al. (2019)	Youth and adult arrests for cannabis possession after decriminalization and legalization of cannabis	38 U.S. states	Adult-use legalization	• Crime and social outcomes
Pravosud, V. et al. (2024)	Cannabis legalization and changes in cannabis and tobacco/nicotine use and co-use in a national cohort of U.S. adults during 2017-2021	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions • Other substance use
Prestemon, J.P. et al. (2019)	Cannabis legalization by states reduces illegal growing on US national forests	48 coterminous states plus Alaska	Adult-use legalization	• Other: Cannabis markets
Raman, S. & Bradford, A.C. (2022)	Recreational cannabis legalizations associated with reductions in prescription drug utilization among Medicaid enrollees	All 50 states	Adult-use legalization	• Other substance use
Raman, S. et al. (2023)	Recreational cannabis and opioid distribution	All 50 states and DC	Adult-use legalization	• Other substance use
Reed, S.E. et al. (2024)	Latent profile analysis of college students' alcohol and cannabis co-use patterns after recreational cannabis legalization	49 U.S. states	Adult-use legalization	• Cannabis use and perceptions • Other substance use
Reid, J.L. et al. (2023)	Minimum legal age laws and perceived access to cigarettes, e-cigarettes, and other substances among youth in Canada, England, and the United States: 2017-2021	Canada: All 10 provinces; U.S.: All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions
Rivera-Aguirre, A. et al. (2022)	Does recreational cannabis legalization change cannabis use patterns? Evidence from secondary school students in Uruguay	Urban areas of Uruguay and Chile	Adult-use legalization (2014) ; Opening of self-growers and cannabis clubs	• Cannabis use and perceptions
Roth, W. et al. (2022)	Changes in California cannabis exposures following recreational legalization and the COVID-19 pandemic	California	Adult-use legalization (2016)	• Other health outcomes

Author (Year)	Title	Location	Policy Change	Outcome Category
Sabia, J.J. et al. (2024)	The effects of recreational marijuana laws on drug use and crime	All 50 states and DC	Adult-use legalization; Adult-use retail sales	• Cannabis use and perceptions • Other substance use • Other health outcomes • Crime and social outcomes
Santaella-Tenorio, J. et al. (2020)	Association of recreational cannabis laws in Colorado and Washington State with changes in traffic fatalities, 2005-2017	CO, WA (Treated); Donor pool of U.S. states that did not include those who legalized adult-use cannabis (Control)	Adult-use retail sales (2014)	• Traffic crashes and mortality
Segura, L.E. et al. (2025)	Gender differences in cannabis outcomes after recreational cannabis legalization: A United States repeated cross-sectional study, 2008-2017	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions
Sennott, C. et al. (2022)	The liberalization of cannabis possession laws and birth outcomes: A state-level fixed effects analysis, 2003-2019	All 50 states and DC	Adult-use legalization	• Other health outcomes
Shanaev, S. et al. (2024)	When bitcoin is high: cryptocurrency value, illicit markets and US marijuana bills	All 50 states and DC	Adult-use legalization	• Other: Illegal markets
Sheehan, B.E. et al. (2021)	Association of racial disparity of cannabis possession arrests among adults and youths with statewide cannabis decriminalization and legalization	39 U.S. states	Adult-use legalization	• Crime and social outcomes
Shi, Y. et al. (2019)	Recreational marijuana legalization and prescription opioids received by Medicaid enrollees	CO, WA, AK, DC, OR, CA, MA, ME, NV (Treated); HI, MI, MT, NM, RI, VT (Control)	Adult-use legalization	• Other substance use
Shi, Y. & Liang, D. (2020)	The association between recreational cannabis commercialization and cannabis exposures reported to the US National Poison Data System	All 50 states and DC	Adult-use legalization	• Other health outcomes
Skelton, K.R. et al. (2021)	Association of recreational cannabis legalization with maternal cannabis use in the preconception, prenatal, and postpartum periods	AK, ME (Treated); NH, VT (Control)	Adult-use legalization	• Cannabis use and perceptions

Author (Year)	Title	Location	Policy Change	Outcome Category
Soh, J. et al. (2024)	Trends of emergency department visits for cannabinoid hyperemesis syndrome in Nevada: An interrupted time series analysis	Nevada	Adult-use retail sales	• Other health outcomes
Stanton, D. et al. (2020)	The effect of marijuana legalization on jail populations in Washington State	WA	Adult-use legalization (2012)	• Crime and social outcomes
Steuart, S.R. et al. (2025)	Recreational cannabis laws and fills of pain prescriptions in the privately insured.	All 50 states and DC	Adult-use legalization	• Other substance use
Thacker, J. et al. (2021)	Exploring the neighborhood-level impact of retail marijuana outlets on crime in Washington State	Three cities in WA (Seattle, Bellevue and Tacoma)	Adult-use retail sales	• Crime and social outcomes
Veligati, S. et al. (2020)	Changes in alcohol and cigarette consumption in response to medical and recreational cannabis legalization: Evidence from U.S. state tax receipt data	All 50 states	Adult-use legalization	• Other substance use
Voy, A. (2023)	Collisions and cannabis: measuring the effect of recreational marijuana legalization on traffic crashes in Washington State	Washington State	Adult-use legalization (2012); Adult-use retail sales (2014)	• Traffic crashes and mortality
Vuolo, M. et al. (2022)	Further consideration of the impact of tobacco control policies on young adult smoking in light of the liberalization of cannabis policies	All 50 states and DC	Adult-use legalization	• Other substance use
Walker, M. et al. (2023)	The effect of recreational cannabis legalization on rates of traffic injury in Canada	Alberta, Ontario, British Columbia, Manitoba, Saskatchewan, Nova Scotia, New Brunswick, Newfoundland and Labrador, and Prince Edward Island	Adult-use legalization (2018)	• Traffic crashes and mortality
Wallace, C.T. et al. (2025)	Marijuana legalization and drug abuse as a cause for entry into foster care	All 50 states and DC	Adult-use legalization	• Other: Foster care
Walsh, P.S. et al. (2024)	Cannabis legalization and resource use for ingestions by young children	27 U.S. states	Adult-use legalization	• Other health outcomes

Author (Year)	Title	Location	Policy Change	Outcome Category
Wang, P. et al. (2019)	Frontiers: Asymmetric effects of recreational cannabis legalization	AK, CA, DC, ME, MA, NV, OR (Treated); 10 U.S. states without any form of cannabis policy change (Control)	Adult-use legalization	• Other: Internet searches
Wang, G.S. et al. (2021)	Changes in emergency department encounters for vomiting after cannabis legalization in Colorado	CO	Adult-use retail sales (2014)	• Other health outcomes
Wang, G.S. et al. (2022)	Impact of cannabis legalization on healthcare utilization for psychosis and schizophrenia in Colorado	CO	Adult-use retail sales (2014)	• Other health outcomes
Wang, G.S. et al. (2022)	Cannabis legalization and cannabis-involved pregnancy hospitalizations in Colorado	Colorado	Adult-use retail sales (2014)	• Other health outcomes
Weinberger, A.H. et al. (2021)	A difference-in-difference approach to examining the impact of cannabis legalization on disparities in the use of cigarettes and cannabis in the United States, 2004-17	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions • Other substance use
Weinberger, A.H. et al. (2022)	Impact of cannabis legalization in the United States on trends in cannabis use and daily cannabis use among individuals who smoke cigarettes	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions
Wen, J. et al. (2021)	The impact of medical and recreational marijuana laws on opioid prescribing in employer-sponsored health insurance	All 50 states	Adult-use legalization	• Other substance use
Wilds, K.M. & Riddell, J.R. (2023)	Cannabis policy and consumption: Taking into account substitution effects	All 50 states and DC	Adult-use legalization	• Cannabis use and perceptions • Other substance use
Willits, D. W. et al. (2022)	Racial disparities in the wake of cannabis legalization: documenting persistence and change	CO, WA	Adult-use legalization (2012)	• Crime and social outcomes
Windle, S.B. et al. (2021)	Association between legalization of recreational cannabis and fatal motor vehicle collisions in the United States: an ecologic study	10 U.S. states and DC that had legalized adult-use cannabis before 2019	Adult-use legalization	• Traffic crashes and mortality

Author (Year)	Title	Location	Policy Change	Outcome Category
Worrall, J.L. et al. (2022)	Marijuana legalization and U.S. postal inspection service seizures: An exploration of black market activity	All 50 states and DC	Adult-use legalization	• Crime and social outcomes
Wu, G. et al. (2020)	The spillover effect of recreational marijuana legalization on crime: Evidence from neighboring states of Colorado and Washington State	Border counties of WA, CO (Treated); Non-border counties of WA, CO (Control)	Adult-use legalization (2012)	• Crime and social outcomes
Wu, G. et al. (2021)	Impact of recreational marijuana legalization on crime: Evidence from Oregon	OR (Treated); 19 states that had not legalized adult-use or medical cannabis (Control)	Adult-use legalization (2014)	• Crime and social outcomes
Wu, G. et al. (2022)	Effects of recreational marijuana legalization on clearance rates for violent crimes: Evidence from Oregon	OR (Treated); 19 states that had not legalized adult-use or medical cannabis (Control)	Adult-use legalization (2014)	• Crime and social outcomes
Wu, G. & Cullenbine, R.R. (2022)	Recreational marijuana legalization and drug-related offenses in Washington State: an interrupted time series analysis with a combination of synthetic controls	WA (Treated); 40 states that had not legalized adult-use cannabis by 2019 (Control)	Adult-use legalization (2012)	• Crime and social outcomes
Wu & Willits (2022)	The impact of recreational marijuana legalization on simple assault in Oregon	OR (Treated); 19 states that had not legalized adult-use or medical cannabis (Control)	Adult-use legalization (2014)	• Crime and social outcomes
Wu, G. et al. (2023)	Marijuana legalization and racial disparities in prison incarceration in Colorado and Washington State: a quasi-experimental study	WA, CO (treated); A pool of 30 U.S. states that had not legalized adult-use cannabis	Adult-use legalization (2012)	• Crime and social outcomes
Wu, G. et al. (2023)	Impact of recreational cannabis legalization on adolescent cannabis use in Washington State	WA (treated) and 40 U.S. states that had not legalized for adult-use cannabis	Adult-use legalization (2012); Adult-use retail sales (2014)	• Cannabis use and perceptions
Wu, G. et al. (2024)	Pipe dreams: Cannabis legalization and the persistence of racial disparities in jail incarceration	CO, WA (treated); 34 U.S. states that had not legalized adult-use cannabis by 2019 (control)	Adult-use legalization	• Crime and social outcomes
Yang, K.H. et al (2024)	State cannabis and psychedelic legislation and microdosing interest in U.S.	48 U.S. states	Adult-use legalization	• Other substance use
Yeung, M.E.M. et al. (2020)	Clearing the air: A study of cannabis-related presentations to urban Alberta	14 urban EDs in Alberta	Adult-use legalization (2018)	• Other health outcomes

Author (Year)	Title	Location	Policy Change	Outcome Category
Yeung, M.E.M. et al. (2021)	emergency departments following legalization Emergency department pediatric visits in Alberta for cannabis after legalization	All urban EDs in Alberta	Adult-use legalization (2018)	• Other health outcomes
Young-Wolff, K.C. et al. (2024)	Cannabis use during early pregnancy following recreational cannabis legalization	Northern California	Adult-use legalization (2016)	• Cannabis use and perceptions
Zambiasi, D. & Stillman, S. (2019)	The pot rush: Is legalized marijuana a positive local amenity?	CO (Treated); Donor pool of 20 states that had not legalized adult-use cannabis by 2017 (Control)	Adult-use legalization (2012)	• Employment and economics • Crime and social outcomes

NOTE: Tables features basic bibliographic information, policy context, and outcome category for each study.

Table 6. Literature Review Outcomes and Study Methods

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Abouk, R. et al. (2023)	1) Past-month cannabis use; 2) Past-year cannabis use; 3) Cannabis-related admissions to substance use disorder treatment; 4) Prescription medication fills that are used to treat chronic pain and reimbursed by Medicaid; 5) Number of non-fatal workplace injuries involving days away from work; 6) Any workers' compensation income; 7) Level of workers' compensation income in 2018 dollars	U.S. adults aged 40-62; Note: cannabis use outcomes are among 26+	2010–2018	Cannabis use data: NSDUH files; Cannabis treatment data: Treatment Episode Dataset (TEDS); Drug data: Medicaid State Drug Utilization Database (SDUD); Workplace injury data: Bureau of Labor Statistics data and BLS Survey of Occupational Injuries and Illnesses; Employment data: CPS data; Establishment data: U.S. County Business Patterns dataset	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use cannabis	Difference-in-differences (DiD)
Adhikari, K. et al. (2023)	Annual traffic fatalities per billion vehicle miles driven	U.S. residents that had suffered a fatal motor collision between 2007-2020	2007–2020	Fatality data: National Highway Traffic Safety Administration's Fatality Analysis Reporting System; VMT data: Policy and Governmental Affairs Office of Highway Policy Information	U.S states that had adult-use retail stores	U.S states that did not have adult-use cannabis retail stores	DiD and DiD accounting for staggered adoption
Alcocer, JJ. (2020)	Opioid overdose mortality rates per 100,000 in the population	Residents that had suffered a fatal opioid overdose	1999–2017	Opioid overdose death rate data: Centers for Disease Control and Prevention's Wide-ranging Online Data	CO	Synthetic control of a donor pool of states resembling CO	DiD using synthetic controls

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
				for Epidemiologic Research (WONDER); Demographic data: American Community Survey			
Alexander, G.D. et al. (2024)	1) Units of grams per million people per year for individual stimulants; 2) daily doses per hundred million people per year for the aggregate stimulant	Distribution of Schedule II stimulants in the U.S.	2006–2021	Automation of Reports and Consolidated Orders System (ARCOS); American Community Survey	U.S. states that had adult-use retail stores	All other states	Interrupted Time Series Analysis (ITSA)
Ali, M.M. et al. (2022)	1) Use of cannabis: Past month use; past year use; cannabis use disorder; frequent use in the past year; frequent use among consumers; 2) Use of alcohol: Past month use; past year use; alcohol use disorder; frequent use in the past year; frequent use among consumers; 3) Use of prescription opioids: Past month use; past year use; prescription opioid use disorder; frequent use in the past year; frequent use among consumers; 4) Use of heroin: Past month use; past year use; heroin use disorder; frequent use in the past year; frequent use among consumers; 5) Use of stimulants: Past month use; past year use; stimulant use disorder; frequent use in the past year; frequent use among consumers	U.S. residents aged 19+	2004–2020	National Survey on Drug Use and Health	12 states and DC that had legalized adult-use cannabis; 10 states that had adult-use retail stores.	U.S. states that had not legalized adult-use cannabis; US states that did not have adult-use retail stores.	DiD and DiD accounting for staggered adoption

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Alley, Z.M. et al. (2020)	1) Past month nicotine use (cigarettes, tobacco from water pipe, cigars, clove cigarettes); 2) Past month illicit drug use (cocaine, methamphetamine, amphetamines, sedatives, hallucinogens, anabolic steroids, opiates, inhalants, club drugs, and other illegal drugs); 3) Binge drinking in the past 2 weeks (consuming five or more drinks of alcohol at least once); 4) Use of opioids without a prescription in the past 12 months (e.g., OxyContin, Vicodin, Codeine); 5) Use of sedatives without a prescription in the past 12 months (e.g., Xanax, Valium); 6) Use of stimulants without a prescription in the past 12 months (e.g. Ritalin, Adderall)	Undergraduates aged 18-26 attending four-year colleges and universities	2008–2018	National College Health Assessment-II Survey	7 U.S states that had legalized adult-use cannabis by 2018	41 U.S. states that had not legalized adult-use cannabis by 2018	Natural experiment: regression analyses
Anderson, D.M. et al. (2019)	1) Past-30-day cannabis use; 2) Frequent cannabis use (at least 10 times in the past 30 days)	U.S. high school students (grades 9-12)	1993–2017	Youth Risk Behavior Surveys (YRBS)	U.S. states that have legalized adult-use cannabis	U.S. states that have not legalized adult-use cannabis	Natural experiment: regression analyses
Anderson, D.M. et al. (2021)	1) Past month use (any use in past 30 days); 2) Frequent use (at least 10 times in the past 30 days)	U.S. high school students (grades 9-12)	1993–2019	Youth Risk Behavior Survey	10 U.S. states that had legalized adult-use cannabis (exact states not defined) 7 U.S. states that had adult-use	U.S. states that had not legalized adult-use cannabis U.S. states that did not have	Natural experiment: regression analyses

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Anderson, D.M. et al. (2024)	1) Past 30-day cannabis use; 2) Use at least 10 times in the past 30 days (frequent cannabis use)	Middle and high school students	1993–2021	Youth Risk Behavior Surveys (YRBS)	retail stores in operation (exact states not defined) 12 and 16 US jurisdictions with adult-use legalization in effect for national and state-level YRBS data, respectively; 9 and 8 US jurisdictions with adult-use retail markets in operation for national and state-level YRBS data, respectively.	adult-use retail stores U.S. states pre-adult-use legalization and states that had not legalized adult-use cannabis	Natural experiment: regression analyses
Anderson, K.K. et al. (2024)	1) Incidence of non-affective psychotic disorder (e.g., schizophrenia, schizoaffective disorder, schizophreniform disorder, psychosis NOS) per 100,000 population; 2) Incidence of substance-induced psychotic disorders per 100,000 population; 3) Incidence of affective psychotic disorders per 100,000 population; 4) Incidence of all psychotic disorders per 100,000 population	Ontario residents aged 14-60 eligible for OHIP - covering nearly the entire population of Ontario	2014–2020	Population-based health administrative data from Institute for Clinical Evaluative Sciences; Registered Persons Database; Immigration, Refugee, and Citizenship Canada Permanent Resident databases; National Ambulatory Care Reporting System; Ontario Mental Health Reporting System; Discharge Abstracts Database	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
Armstrong, M.J. et al. (2022)	Legal sales total per capita (aged 15 and over)	Legal cannabis sales in Canada	2019–2021	Store data: each jurisdiction's cannabis agency website.	Post-legalization (Phase 2)	Pre-legalization (Phase 2)	ITSA

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Armstrong, M (2024)	1) Registration change: patient registrations per 10,000 residents in each province and month; 2) Frequency of medical cannabis purchases: provincial frequency of medical cannabis purchases per 100 registrations; 3) Recreational sales per capita	Monthly registrations and purchases made by medical cannabis patients	2017–2022	Medical cannabis registration and shipment data from Health Canada; medical cannabis sales from Statistics Canada; seasonally adjusted Canadian dollar totals for North American Industry Classification System (NAICS) categories 44 and 45	Post-passage Post-legalization (Phase 1) Post-legalization (Phase 2)	Pre-passage Pre-legalization (Phase 1) Pre-legalization (Phase 2)	ITSA
Armstrong, M.J. et al. (2024)	1) Natural logarithm of Per capita price-adjusted alcohol retailer sales value (\$CAD); 2) Natural logarithm of Per capita price-adjusted beer producer sales volume (liters of product)	Sales data of alcohol in Canada	2004–2022	Statistics Canada; Beer Canada.	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
Aydelotte, J.D. et al. (2019)	Fatal crashes per billion vehicle miles travelled	Residents that had suffered a fatal vehicle collision	2007–2017	Fatality data: National Highway Traffic Safety Administration's Fatality Analysis Reporting System; VMT data: Federal Highway Administration Traffic Volume Trends reports	CO, WA	Nine control states with stable anti-cannabis or medical cannabis status	DiD
Bae, H. & Kerr, D.C.R. (2019)	1) Past 30-day cannabis use; 2) Frequent cannabis use (20+ days)	Undergraduates aged 18-26 attending four-year colleges and universities	2008–2018	National College Health Assessment-II Survey	7 U.S. states that had legalized adult-use cannabis by 2018	41 U.S. states that had not legalized adult-use cannabis by 2018	Natural experiment: regression analyses

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Baggio, M. & Chong, A. (2020)	Monthly retail sales in US dollars of high calorie snack foods (ice cream, cookies and chips)	Residents that had purchased 'junk' food	2006–2016	Nielsen Retail Scanner database	U.S. states that legalized adult-use cannabis (CO, WA, AK, OR, DC, CA, ME, MA, NV)	U.S. states that legalized medical cannabis before 2006 but not adult-use cannabis	DiD with reduced-form specification that exploits spatial discontinuity
Baggio, M et al. (2024)	Intimate Partner Violence rate per 100,000 at the state-month level	Individuals aged 18+ or missing among states with consistent incident-level reporting between 2006 - 2016 and in a county with a population above 1000	2006–2016	National Incident-Based Reporting System (NIBRS) ; Covariate data sources: Surveillance, Epidemiology, and End Results (SEER); Local Area Unemployment Statistics and the Small Area Income and Poverty Estimates; American Community Survey; Tax Policy Center; PRISM climate data ; Mechanism data sources: Behavioural Risk Factor Surveillance System (BRFSS); Apparent Per Capital Alcohol Consumption: National States and Regional Trends 1977-2018	CO, OR, WA, DC	All other states	Event study analysis, DiD and DiD accounting for staggered adoption
Bai, Y. et al. (2025)	1) Cannabis-related ED visits; 2) Opioid-related ED visits ; 3) Alcohol-related ED visits	Adults in Ontario aged 18 and above	2016–2023	Institute for Clinical Evaluative Sciences (ICES)	FSAs with dispensaries	FSAs without dispensaries	DiD accounting for staggered adoption
Barker, A.K. & Moreno, M.A. (2021)	1) Proportion of participants who have ever used cannabis; 2)	Undergraduate students at two	2011–2016	Data from an overarching mixed methods study of	WA	WI	Natural experiment: time series

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	Proportion of ever cannabis users who used in the last 28 days; 3) Mean attitude score of participants ("on a scale between 0 and 6, with 0 as very negative, 3 as neutral and 6 as very positive, what is your own attitude to marijuana); 4) Mean intention score of participants (How likely do you think it is that you will use marijuana in the next 6 months - 0 is not at all likely, 5 is very likely)	large public universities		substance use and social media practices			analysis with regression.
Bass, B. et al. (2024)	Cannabis use disorder treatment admission	All publicly funded substance use disorder treatment delivered in California	2010–2021	California Outcomes Measurement System, Treatment (CalOMS-Tx); American Community Survey; Judicial Council of California; Department of Justice's Open Justice website; CA Department of Health Care Services; University of Arizona's Research on COVID-19 Interventions and Impacts Group	Post-legalization in CA	Pre-legalization in CA	ITSA
Beasley, W.J. & Dundas, S.J. (2024)	1) Mean MME of prescription opioids per capita; 2) All opioid, heroin-related, and non-heroin related mortality (deaths per 100,000 residents)	Adults in Oregon aged 18 and above	2014–2017	Oregon Medical Marijuana Program (MMP), Oregon Liquor Control Commission (OLCC), the American Community Survey (ACS)	Post-legalization in OR and differential dispensary access	Pre-legalization in OR	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Bednarek, Z. et al. (2022)	Daily stock return (difference between stock price today and day before, divided by price from day before)	Stock returns from 556 publicly listed U.S. pharmaceutical companies	1996–2019	Stock returns: publicly listed companies from the Wharton Research Data Services' Center for Research in Security Prices (CRSP), and the University of Chicago ; Daily time-series data underlying factor pricing model: Ken French's data library	Realized returns and stock prices among U.S. states that had legalized adult-use cannabis	Predicted returns and stock prices among U.S. states that had legalized adult-use cannabis	Event study analysis
Bennett, C.E. et al. (2022)	Hallucinogen-related ingestions	Inpatient, ED and observation encounters for children under 6 years with cannabis exposures	2004–2018	Pediatric Health Information System database	5 U.S. states and DC that had legalized adult-use cannabis	All other states, controlling for MML	DiD
Blake, C.D. et al. (2023)	1) Log of college applications (quantity); 2) log of 75th percentile SAT/ACT scores of admitted students (quality)	College applications in U.S.	2008–2019	Integrated Post Secondary Educational Data System (IPEDS); Covariates: Bureau of Labor Statistics	11 U.S. jurisdictions that had legalized adult-use cannabis (AK, CA, CO, DC, ME, MA, MI, NV, OR, VT, WA); Note that this is taken from an unclear figure in the article.	All other states	Event study analysis, DiD and DiD accounting for staggered adoption (with propensity score matching)
Blalthrop, A. et al. (2024)	Natural log of truck accidents per 100,000 people	All crashes of DOT-registered vehicles involving a fatality or injury or requiring a vehicle to be towed away	2005–2021	Federal Motor Carrier Safety Administration (FMCSA); Marijuana Policy Project (MPP); US Census Bureau (Census); Bureau of Transportation Statistics (BTS); Bureau of Labor	14 U.S. states that had legalized adult use cannabis (WA, VA, VT, OR, NV, NY, NM, NJ, ME, MA, MI, IL, CT, CO, CA)	Control group of all non-legalized states	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
				Statistics (BLS); National Highway Traffic Safety Administration (NHTSA); Insurance Institute for Highway Safety (IIHS); Federal Highway Administration (FHA); Bureau of Economic Analysis (BEA).			
Bleyer, A. et al. (2024)	1) Opioid-related overdose deaths per 100,000 people; 2) Potent fentanyl overdose deaths per 100,000 people	U.S. adults	2010–2019	CDC WONDER database	Post-legalization	Pre-legalization	Joinpoint nonparallel pairwise comparison
Borbely, D. et al. (2022)	1) Number of bad mental health days per month; 2) K6 scale (Kessler Psychological Distress Scale); Scores >12 = severe mental distress ; Scores > 4 = moderate mental distress; 3) Past month cannabis use	Non-institutionalized adults living in the U.S. 18-99	1993–2019	BRFSS	11 U.S. jurisdictions that had legalized adult-use cannabis (AK, CA, CO, DC, ME, MA, MI, NV, OR, VT, WA)	All other states	DiD and DiD accounting for staggered adoption
Bourdon, J.L. et al. (2021)	1) Outpatient treatment completion (yes, no); 2) Length of stay in treatment (<90 days vs. 90+ days)	U.S. adults aged 18+ whose primary substance at admission at an outpatient facility was cannabis	2006–2017	Treatment Episode Data Set-Discharge (TEDS-D)	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use cannabis, but had a medical cannabis policy or decriminalization	DiD
Bradford, A.C. et al. (2024)	1) Number of patients with prescription filled per 10,000 enrollees per state-quarter; 2) Mean days' supply per prescription fill; 3) Mean number of prescription fills per patient per state-quarter	Commercially insured patient dispensed prescriptions for benzodiazepines, antidepressants, antipsychotics, barbiturates, or	2007–2020	Clinformatics Data Mart Database	U.S. jurisdictions that had legalized adult-use cannabis (states were also run separately)	Donor pool of never-treated states (no MML, RML)	DiD with synthetic controls

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Brinkman, J. & Mok-Lamme, D. (2019)	Crime rate per 10,000 residents	sleep medications and with a non-cancer status. Adults in Denver	2013–2016	Dispensary data: Colorado Department of Revenue; Crime data: City and County of Denver's extensive online data catalog; Federal Bureau of Investigation's Uniform Crime Reporting Program data; IV data: U.S. Census TIGER database; Demographic data: American Community Survey; Employment data: U.S. Census Longitudinal Employer-Household Dynamics Origin-Destination Employment Statistics; Geographic data: City and County of Denver's Community Planning and Development Department	Census tracts in Denver, CO, that gained an adult-use cannabis dispensary	Census tracts in Denver, CO, that had no change in dispensary density	Instrumental Variables
Britton, E.M. et al. (2024)	1) Frequency of cannabis use; 2) Severity of cannabis use using DSM-5 CUD checklist ; 3) Proportion of patients screening positive for CUD ; 4) Readiness to quit using cannabis (scale of 1-10)	Individuals who voluntarily entered large inpatient SUD treatment program	2017–2021	Large inpatient SUD treatment program in Guelph, Ontario	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Brushwood, J.D. et al. (2020)	Natural log of accounting and auditing expenses during the year	Cannabis businesses	2011–2016	Bank-level data: FDIC Call Reports from Federal Financial Institutions Examinations Council (FFIEC) website	U.S. states that had legalized adult-use cannabis	Matched group of U.S. states that had not legalized adult-use cannabis	DiD
Brushwood, J.D. et al. (2023)	1) Log of audit and audit-related fees; Log of non-audit fees	Cannabis (cannabis growers, processors, retailers, service providers, pharmaceutical companies, and other companies involved in cannabis) and non-cannabis companies on the Canadian Stock market	2012–2021	Audit Analytics; SEDAR filings	Cannabis companies	Non-cannabis companies	Natural experiment (but model approximates DiD)
Bruzelius, E & Martins, S.S. (2024)	1) Immigration arrests referencing cannabis possession; 2) Immigration deportations referencing cannabis possession	Immigration arrests and deportations referencing cannabis possession	2014–2018 (arrests); 2009 –2020 (deportations)	Transactional Records Access Clearinghouse; National Center for Health Statistics	U.S. state had legalized adult use cannabis	All other states	Event study analyses; Natural experiment: regression models
Buttorf, C. et al. (2023)	1) Number of 30-day fills per county resident; 2) Total MME per capita; 3) Number of opioid-related inpatient visits per capita per county ; 4) Number of opioid-related ED visits per capita per county	Colorado residents	2011–2018; 2013 –2018	Dispensary data: Colorado Department of Revenue ; Opioid data: Prescription Drug Monitoring Program (PDMP) database ; Hospital data: Colorado Hospital Association data on inpatient and emergency department visits (codes include opioid use, misuse or dependence (F11*),	CO counties with exposure to one or more adult-use stores	CO counties with no exposure to one or more adult-use stores	DiD accounting for staggered adoption

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Calcaterra, S.L. et al. (2019)	1) Annual incidence rate per 10,000 encounters with ICD-9/10-CM codes for cannabis or alcohol; 2) Monthly rates of emergency encounters possibly related to cannabis; 3) Monthly rates of hospital encounters possibly related to cannabis; 4) Monthly rates of combined ED and hospital encounters possibly related to cannabis; 5) Monthly rates of emergency encounters possibly related to alcohol; 6) Monthly rates of hospital encounters possibly related to alcohol; 7) Monthly rates of combined ED and hospital encounters possibly related to alcohol	Patients who accessed care at Denver Health, CO	2009–2015	opioid poisonings (T400*–T404*, T406*, and T507*), and the long-term use of opioids (Z798*). ; Demographics: Bureau of Labor Statistics, American Health Resource File. Denver Health data warehouse; Demographic and insurance data: registration data	After adult-use retail sales in CO	Before adult-use retail sales in CO	ITSA
Callaghan, R.C. et al. (2021)	An occurrence of a ICD-10-CA code to identify an MVC-related traffic injury among drivers	Drivers of minimum driving age (16 years in Ontario, 14 years in Alberta) who presented to an ED in Ontario or Alberta for being in	2015–2019	National Ambulatory Care Reporting System - data from all Ontario and all Alberta Eds	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Callaghan, R.C. et al. (2021)	1) Total cannabis-related criminal offences; 2) All violent crime offences 3) All property crime offences	a motor vehicle collision related incident Youth aged 12-17 who had a cannabis-related offense reported to police	2015–2018	Uniform Crime Reporting (UCR-2) incident-based survey - a national database held by Canadian Centre for Justice Statistics	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
Callaghan, R.C. et al. (2022)	Any occurrence at ED for: 1) Cannabis-induced psychosis; 2) Schizophrenia and related disorders Any occurrence at ED for: 3) Alcohol-induced psychosis; 4) Amphetamine-induced psychosis	Patients presenting to ED's in Ontario and Alberta for the four outcomes	2015–2019	National Ambulatory Care Reporting System - data from all Ontario and all Alberta Eds	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
Callaghan, R.C. et al. (2023a)	ED visits for: 1) Cannabis-related disorders (ICD-10-CA F12.X); 2) Cannabis poisonings (T40.7)	Youth - defined as those under the minimum legal age to purchase cannabis (<18 in Alberta, <19 in Ontario) - presenting to emergency departments in Ontario and Alberta for cannabis-related disorders or poisonings	2015–2019	National Ambulatory Care Reporting System	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
Callaghan, R.C. et al. (2023b)	1) Cannabis-related offences (possession, trafficking/distribution/sale, importation/exportation, and production) ; 2) All	Adults 18+	2015–2021	Uniform Crime Reporting Survey (UCR-2) survey data	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	property crime offences (Violations primarily involving arson, breaking and entering, theft, possession/trafficking of stolen goods, fraud, or mischief) ; 3) All violent crime offences (Comprised primarily of violations causing death, attempting the commission of a capital crime, sexual violations, assaults and firearm-related offences, violations resulting in the deprivation of freedom (e.g., kidnapping, abduction), other violations involving violence or the threat of violence (e.g. robbery, extortion, uttering threats), or the commodification of sexual activities)						
Callaghan, R.C. et al. (2024)	1) Cannabis-related offenses; 2) Property crime offenses; 3) Violent crime offenses	Youth ages 12-17 years	2015–2021	Canadian Uniform Crime Reporting Survey (UCR-2)	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
Calvert, C. & Erickson, D. (2020)	1) Monthly rates of fatal motor vehicle crashes per 100,000 people; 2) Monthly rates of fatal pedestrian-involved crashes per 100,000 people	Residents that had suffered a fatal motor collision	1991–2018	Crash data: Fatality Analysis Reporting System (FARS)	CO, WA, OR - three states that had legalized adult-use cannabis	AR (CO's control); WI (WA's control); IA (OR's control) WI (CO's control); IN (WA's control); KY (OR's control)	DiD, ITSA
Calvert, C.M. & Erickson, D. (2021)	Monthly milliliters of pure ethanol purchased for: 1) Beer ; 2) Wine ; 3) Spirits ; 4) All alcohol products	Alcohol purchasing U.S. residents	2004–2017	Nielsen Retail Scanner database	CO, WA, OR - three states that had legalized adult-use cannabis	NJ (CO's control); TX (WA's control); VA (OR's control)	Controlled interrupted time series analysis (C-ITSA)

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
						NC (CO's control); IL (WA's control); WV (OR's control)	
						All other U.S. states that had not legalized adult-use cannabis	
Castillo-Carniglia, A. et al. (2023)	Rate of opioid- and/or benzodiazepine-related poisoning deaths, aggregated at county level: Primary analysis: 1) Any opioid ; 2) Any benzodiazepines ; 3) Any opioids and benzodiazepines ; Secondary analysis ; 4) Natural and semi-synthetic opioids ; 5) Synthetic opioids ; 6) Heroin	Deceased individuals with cause-of-death involving opioids and/or benzodiazepines	2002–2020	National Vital Statistics System; County-level sociodemographic covariates: Geolytics ; State information on drug laws: Prescription Drug Abuse Policy System, Prescription Drug Monitoring Programs Administrator	U.S. states that had legalized adult-use cannabis U.S. states that had adult-use stores	U.S. states that had not legalized adult-use cannabis U.S. states that did not have adult-use stores	Natural experiment: regression analyses
Cerda et al. (2020)	1) Past-month cannabis use in past 12 months; 2) Past-month frequent cannabis use in past 12 months; 3) CUD in past 12 months; 4) Frequent cannabis use among past-month consumers; 5) Past year CUD among past-year consumers	U.S. residents aged 12+ (12–17, 18–25, 26 and older)	2008–2016	National Survey on Drug Use and Health; State demographic data: American Community Survey	U.S. states that legalized adult-use cannabis (CO, WA, AK, OR)	U.S states that did not legalize adult-use cannabis	DiD
Cerda, M. et al. (2024)	1) Any drug overdose deaths; 2) Any opioid-involved deaths ; 3) Natural and semisynthetic opioid-involved deaths ; 4) Heroin-involved deaths ; 5) Synthetic opioid-involved death	Mortality and prescribing data from 2013–2020	2013–2020	National Vital Statistics System's Detailed Multiple Cause of Death Research Files; American Community Survey; National	U.S. states that had legalized adult-use cannabis U.S. states that had adult-use retail sales	U.S. states that had legalized medical cannabis but not adult use. U.S. states that had medical cannabis laws	DiD-analogous approach

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	Median rate differences per 100,000 person-years in: 6) patients filling high dose (≥ 90 MME) ; 7) long duration (≥ 30 days) opioid prescriptions			Forensic Laboratory Information System		and no adult-use retail stores	
Chakraborty, A. et al (2021)	Unemployment ; 1) Unemployment rate ; 2) Log of the size of labor force ; 3) Log of the number of unemployed; Employment ; Number of employees by industry type and overall; ; 4) All industries ; 5) Construction ; 6) Manufacturing ; 7) Natural resources and mining ; 8) Service; Wages ; Average weekly wages by industry type and overall; ; 9) All industries ; 10) Construction ; 11) Manufacturing ; 12) Natural resources and mining ; 13) Service	Employment and wages of Colorado residents	2011–2018	U.S. Bureau of Labor Statistics; (LAUS, QCEW) ; Colorado Department of Revenue ; Colorado Department of Public Health and Environment	CO counties with adult-use retail stores	CO counties without adult-use retail stores	DiD corroborated with Generalized synthetic control method (GSCM)
Chamlin, M.B. (2020)	1) Tax revenue from the sale of alcohol (beer, wine, spirits); 2) Number of fatal motor vehicle crashes involving alcohol	Colorado residents that had purchased alcohol or suffered a fatal motor vehicle collision	2008–2019	Excise tax receipts: Colorado Department of Revenue	Post-legalization in CO	Pre-legalization in CO	ITSA
Chan et al. (2019)	1) Mortality from all opiates; 2) Mortality from prescription opioids; 3) Mortality from synthetic opioids	Census of opioid mortality data in U.S. from 1999–2017	1999–2017	Mortality data: Centers for Disease Control's National Vital Statistics System.; Demographic data: United States Census; Unemployment data:	U.S. states that legalized adult-use cannabis US states that had adult-use cannabis stores	U.S. states that had not legalized adult-use cannabis US states that did not have adult-use cannabis stores	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Chen, W. & French, M.T. (2023)	Natural log of traffic fatalities per 100,000 population	All U.S. traffic fatalities	1990–2019	Bureau of labor statistics; Legal history: National Conference of State Legislatures; Marijuana Policy Project; Prescription Drug Abuse Policy System Traffic fatality data: National Highway Traffic Safety Administration's Fatality Analysis Reporting System; Covariates: Highway statistics from Federal Highway Administration website; CDC WONDER database; U.S. Bureau of Labor Statistics and U.S. Bureau of Economic Analysis.	11 U.S. states with adult-use cannabis laws as of 2019	All other U.S. states U.S. states with medical cannabis laws as of 2019 but not adult-use cannabis laws	DiD
Cil, G. et al. (2023)	Number of substance-related student office discipline referrals per 100 students	122 schools in OR and 248 schools in CT, IL, MT, NY	2012–2019; (2012/13–2018/19)	School discipline referrals from School-Wide Information System (SWIS) ; Geocode data: U.S. Department of Education, Education Demographic and Geographic Estimates Program	Middle and high schools in OR	Middle and high schools in CT, IL, MT, NY	C-ITSA with and without propensity score matching
Coley, R.L. et al. (2021)	1) Frequency of use: Number of times they had used cannabis in the past 30 days; 2) The number of days they had drunk	Adolescents aged 14-18	1999–2017	Youth Risk Behavior Survey	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use cannabis	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	alcohol; 3) The number of days they had smoked cigarettes; 4) The number of days they had used an electronic vapor (e-cigarette) product						
Coley, R.L. et al. (2024)	1) Past month use of cannabis; 2) Past month use of alcohol ; 3) Past month use of cigarettes ; 4) Past month use of e-cigarettes	9th - 12th grade students in the U.S.	2011–2021	Youth Risk Behavior Survey	16 U.S. states that had legalized adult use cannabis 9 U.S. states that had opened adult use stores	All other states	DiD
Connealy, N. et al. (2019)	1) Property crime; 2) Violent crime; 3) Disorder; 4) Drug offences	Residents of Denver, CO, that had a criminal offence	2011–2016	Crime data: Denver police Department's Data Analysis Unit	Streets in Denver, CO with an adult-use retail store	Synthetic control of streets in Denver, CO without an adult-use retail store	Microsynthetic controls
Dave, D. et al. (2023)	Past month cannabis use ; 2) Past month tobacco use ; 3) Past month cigarette use; 4) Past year cannabis use ; 5) Past month cannabis use ; 6) Past month blunt use ; 7) Past month number of days of blunt use ; 8) Past 2-day vaped cannabis ; 9) Ever vaped cannabis; 10) Initiation of cigarettes among non-users ; 11) Cessation of cigarettes among users ; 12) Initiation of cigars among non-users ; 13) Cessation of cigars among users ; 14) Initiation of ENDS among non-users ; 15) Cessation of ENDS among users ; 16) Initiation	Non-institutionalized adult population, 18+	2013–2019	Population Assessment of Tobacco and Health (PATH)	10 U.S. states and DC that had legalized adult-use cannabis by 2019 (AK, CA, CO, ME, MA, MI, NV, OR, VT, WA)	All other U.S. states	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	of cannabis among non-users ; 17) Cessation of cannabis among users; 18) Dual cannabis and tobacco use ; 19) Initiation of cannabis among tobacco users ; 20) Initiation of tobacco among cannabis users ; 21) Dual cannabis and ENDS use						
Dave, D.M., et al. (2025)	1) Past-month cannabis use; 2) Employment status; 3) Log of hourly wage (2020 dollars);	Non-institutionalized adults aged 18-25 and 26 and older Working age U.S. respondents (16-64)	2002–2019	NSDUH; Labor market data: Current Population Survey Outgoing Rotation Groups	U.S. states that had legalized adult-use cannabis US states that had adult-use stores	U.S. states that had not legalized adult-use cannabis US states that did not have adult-use stores	DiD and Synthetic control methods (SCM)
de Assis, B. (2025)	1) Drug-related crime; 2) Drug seizures; 3) Criminal records ; 4) Drug hospitalization	Adults in Brazil	2010–2020	Rio Grande do Sul Department of Public Safety (RSDPS) and Brigada Militar	Post-legalization in UY and travel distance to Uruguay border	Pre-legalization in UY	DiD
De, P.K. & Sun, R. (2025)	1) Current drinking (any drinking in the past 30 days); 2) Binge drinking (consuming 5 or more drinks for men or 4 or more drinks for women on a single occasion); 3) Heavy drinking (more than 14 drinks per week for men and more than 7 drinks per week for women); 4) Current cigarette use (ever smoked >100 cigarettes and currently smoking cigarettes every day or some days); 5) Current smokeless tobacco use (use of chewing tobacco,	Non-institutionalized adults living in the U.S. 18-99	2012–2022	Behavioral Risk Factor Surveillance System (BRFSS); Covariates: American Community Survey	21 U.S. jurisdictions that had legalized adult-use cannabis; 17 U.S. states that had opened retail sales ; See Appendix Table 2	All other states	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	snuff or snus every day or on a few days)						
Delling, F.N. et al. (2019)	1) Cannabis admissions to hospital; 2) Total number of hospital admissions per 1,000 population; 3) Length of inpatient stay; 4) Healthcare costs	Inpatient population of CO, OK, NY	2010–2014	Healthcare Cost and Utilization Project (HCUP) inpatient databases	Inpatients in CO	Inpatients in OK and NY	ITSA
Denkyirah, E.K. et al. (2025)	Opioid death rate (opioid deaths per 100,000 population)	State-level data on opioid mortality.	2003–2018	Centers for Disease Control; Bureau of Labor Statistics; US Census Bureau, American Foundation for AIDs research's Opioid and Health Indicators Database; Kaiser Family Foundation's State Health Facts database; US Census Bureau; National Institute on Alcohol Abuse and Alcoholism	CO, WA, OR (separate)	Donor pool of synthetic control for CO (Minnesota, New Hampshire, Rhode Island, Texas) Donor pool of synthetic control for WA (Florida, Texas, Utah) Donor pool of synthetic control for OR (Florida, Hawaii, North Carolina, Oklahoma, Utah)	SCM
Dewey, J. et al. (2021)	Annual traffic fatalities	Traffic fatalities in the U.S. 1985-2019	1985–2019	Fatality Analysis Reporting System from National Highway Traffic Safety Administration.	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use cannabis	DiD
Dewey, J. & Vadlamani, S. (2023)	The number of pedestrian fatalities (including bicycles and other personal conveyances e.g., skateboard) with and	Residents that have suffered a fatal collision as a pedestrian	1985–2019	Fatality Analysis Reporting System from National Highway Traffic Safety Administration.	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use cannabis	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	without the involvement of alcohol				U.S. states that had adult-use stores	U.S. states that did not have adult-use stores	
Dong, X. (2021)	1) Probability of Monday work injury claims (vs. otherwise); 2) Number of Monday injury claims; 3) Injury claims on each day of the week (vs. otherwise)	Work-related injuries, where the worker gets medical care and misses more than 3 days of work	2013–2018	Workers' Compensation claim data	OR counties that permit adult-use cannabis retail stores	OR counties that do not permit adult-use cannabis retail stores	DiD
Dong, X. & Tyndall, J. (2023)	1) Overall number of crimes occurring within a distance from a dispensary application (crimes include arson, assault, burglary, drug-related, homicide, larceny, motor vehicle theft, robbery, and other) Number of crimes occurring within a distance from a dispensary application for 2) Property crime (motor vehicle theft, larceny, burglary, arson) ; 3) Violent crime (aggravated assault, robbery, homicide) ; 4) Drug-related crime	Crime in three of WA's largest cities	Lottery data: 2014–2016; Crime data: 2010–2016; ACS: 2006–2010	Lottery data: from the Washington State Liquor and Cannabis Board (WSLCB); Crime data: from Seattle Police Department, City of Tacoma Police Department and City of Spokane Police Department - All three cities report and classify crimes under the FBI UCR program ; Neighborhood characteristics data: American Community Survey	Neighborhoods in three of WA's largest cities with a cannabis store that 'won' the lottery	Neighborhoods in three of WA's largest cities with a cannabis store that 'lost' the lottery	Instrumental Variables
Doremus, J.M. et al. (2019)	Monthly OTC sleep aids market share	Over-the-counter medications as product sales as recorded by check-out scanners in Colorado	2012–2014	Nielsen Retail Scanner database	CO counties with adult-use retail stores A greater number of adult-use retail stores	CO counties without adult-use retail stores Fewer or no adult-use retail stores	DiD
Doucette, M.L. et al. (2021)	Death by suicide rate per 100,000	WA, CO residents that had died by suicide	2000–2018	Suicide data: Limited Geography Mortality file from National Center for Health	CO, WA	"Non-treated states" - a weighted combination of a	DiD with SCM

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
				Statistics; Demographics: Current Population Survey microdata from Integrated Public Use Microdata Series; Cannabis data: NSDUH; Firearm data: RAND Corporation		pool of states that did not legalize adult-use cannabis	
Dragone, D. et al. (2019)	Crime rates per 100,000 inhabitants for: 1) Violent crime; 2) Murder; 3) Rape; 4) Assault; 5) Robbery; 6) Property crime; 7) Burglary; 8) Theft	Residents of WA, CO that had committed an offence	2010–2014	Crime data: U.S. Uniform Crime Reporting (UCR); Population data: 2010 U.S. Census; Substance data: NSDUH	WA	OR	DiD and spatial regression discontinuity
Drake, C. et al. (2021)	The number of opioid-related ED visits per 100,000 population from non-federal, non-rehabilitation hospitals	ED patients in 29 states of the HCUP for an opioid-related issue	2011–2017	Hospital data: Healthcare Cost and Utilization Project (HCUP) Fast Stats database; State-level data: RAND-USC Schaeffer Opioid Policy Tools and Information Center; Demographics: American Community Survey	CA, MA, ME, NV	Other 25 U.S. states included in the HCUP that had not legalized adult-use cannabis	Event study analysis
Dranitaris, G. et al. (2021)	1) Mean morphine-equivalent dose (MED) per claim; 2) Total opioid spending per month; 3) Median MED per claim	Canadian residents receiving an opioid prescription through the private or public system	2016–2019	Prescription claims data: IQVIA PharmaStat	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
El Fatmaoui, A. (2024)	1) First-time enrollment; 2) Undergraduate completion and graduation rate	Individuals enrolled in college	2009–2019	Integrated Postsecondary Education Data System (IPEDS) (set of surveys conducted	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult use cannabis	DiD and event study analysis

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
				by the National Center for Education Statistics), Bureau of Economic Analysis, and Bureau of Labor Statistics	CO, WA (together)		
Elser, H. et al. (2023)	1) Counts of psychosis-related diagnosis; 2) Prescribed antipsychotics	All beneficiaries aged 16+ with at least one month of insurance eligibility	2003–2017	Claims data: Optum Clinformatics Data Mart Database; Medicaid Advantage claims database; Cannabis laws: Alcohol Policy Information System cannabis law database; Demographics: American Community Survey; Bureau of Labor Statistics; Small Area Income and Poverty Estimates Program	U.S. states that had legalized adult-use cannabis but did not have retail stores U.S. states with adult-use retail stores	U.S. states without any medical or adult-use law	Panel fixed effects (an extension of DiD)
Everson, E.M. et al. (2019)	1) Reported cannabis use in past 30 days (binary Yes/No); 2) Reported frequent cannabis use in past 30 days (binary: 20 or greater days of use in last 30 days as 'frequent')	Adult residents of Washington State	2009–2016	Washington State Behavioral Risk Factor Surveillance System; For cannabis retailer locations and sale activity: Washington State Liquor and Cannabis Board BioTrackTHC “seed-to-sale” tracking system	Post-legalization in WA across different measures of retail access	Pre-legalization in WA across different measures of retail access	Natural experiment: regression analyses
Farmer et al. (2022)	1) Injury crash rates; 2) Fatal crash rates	Census traffic crashes between 2009-2019 in Western states	2009–2019	Traffic crash data: extracted from state databases.; VMT data: Traffic Volume Trends of the Federal Highway	Western U.S. states that had legalized adult-use cannabis and opened retail	Six remaining western U.S. states that had not legalized adult-use cannabis	ITSA

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
				Administration; Employment data: Bureau of Labor Statistics; Demographic data: Bureau of the Census; Seat belt data: National Center for Statistics and Analysis; Alcohol consumption data: National Institute on Alcohol Abuse and Alcoholism	stores before 2018		
Fink, D.S. et al. (2025)	1 or more cannabis-positive urine drug screens	Veterans' Health Administration emergency department patients aged 18-75 with ≥ 1 ED visit for any reason in a given year	2008–2019	Veterans' Health Administration Corporate Data Warehouse; RAND-USC Opioid Policy Tools and Information Center	12 U.S. states that had legalized adult-use cannabis by 2019	22 U.S. states that had legalized medical cannabis by 2019	DiD accounting for staggered adoption
Firth, C.L. et al. (2020)	1) Aggregate monthly count of cannabis-related allegations; 2) Aggregate monthly count of cannabis-related allegations by race/ethnicity	OR youth aged 10-17 who committed a cannabis-related status and criminal offense	2012–2018	Criminal data: Oregon Juvenile Justice Information System; Population data: Census Bureau and National Center for Health Statistics; Cannabis use data: Student Wellness Survey	Post-legalization in OR	Pre-legalization in OR	ITSA
Gardner, J. & Osei, B. (2022)	Log of entries into foster care for any reason	Youth entrants into the foster care system	2000–2017	Foster care data: Adoption and Foster Care Analysis Reporting System; Demographic data: American Community Survey; Census Bureau, National	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use cannabis	DiD accounting for staggered adoption

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
				Institute on Alcohol Abuse and Alcoholism; State laws; National Organization for the Reform of Marijuana Laws, ProCon.			
Goncalves, P.D. et al. (2022)	Simultaneous (same time or within a couple of hours) cannabis and alcohol use	U.S. respondents aged 12 and older	2008–2019	NSDUH	U.S. states that had adult-use retail stores	U.S. states that did not have adult-use cannabis retail stores but had medical cannabis laws	Natural experiment: regression analyses
Goncalves, P.D. et al. (2023)	1) Past month binge drinking (yes/no) defined as consuming ≥ 5 standard drinks per drinking session regardless of gender.	Non-institutionalized individuals 12+	2008–2019	NSDUH	8 U.S. states and DC with a legal supply of adult-use cannabis (i.e., retail stores or home cultivation)	U.S. states with medical cannabis laws	Natural experiment: regression analyses
Goodman, S. & Hammond, D. (2021)	Noticing cannabis health warning labels (yes, no)	Respondents aged 16-65	2018–2019	International Cannabis Policy Study	Canada	U.S. states that had legalized adult-use cannabis	Natural experiment: regression analyses
						U.S. states that had not legalized adult-use cannabis	
Goodman, S. & Hammond, D. (2022)	Knowledge score (0-7) constructed from the following 7 questions: 1) Can it be dangerous to drive or operate machinery after using marijuana?; 2) Can it be harmful to use marijuana when pregnant or breastfeeding?; 3) Can marijuana be addictive?; 4)	Respondents aged 16-65	2018–2019	International Cannabis Policy Study	Canada	U.S. states that had legalized adult-use cannabis	Natural experiment: regression analyses
						U.S. states that had not legalized adult-use cannabis	

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	Are teenagers at greater risk of harm from using marijuana than adults?; 5) Can marijuana smoke be harmful?; 6) Can regular use of marijuana increase the risk of psychosis and schizophrenia?; 7) Can using marijuana cause diabetes?						
Goodman, S. et al. (2022)	Free recall of any health warning messages (open text recoded to yes or no) ; Valid health warnings were those that were implemented in the jurisdiction at the time of the survey	Past year cannabis consumers aged 16-65	2018–2020	International Cannabis Policy Study	Canada	U.S. states that had legalized adult-use cannabis U.S. states that had not legalized adult-use cannabis	Natural experiment: regression analyses
Goodwin, R.D. et al. (2021)	1) Past-month cannabis use; 2) Past month daily cannabis use	Respondents aged 18 and older who reported having children ages 18 or younger living in the home	2004–2017	NSDUH	U.S. state that had legalized adult-use cannabis	U.S. states that had not legalized adult use or medical cannabis	DiD
Goodwin, R.D. et al. (2023)	Rate of pediatric asthma	Non-institutionalized children aged 0-17	2011–2019	National Survey on Children's Health	11 U.S states that had legalized adult-use cannabis (AK, CA, CO, DC, MA, ME, MI, NV, OR, VT, WA)	U.S. state that had not legalized adult-use or medical cannabis	DiD
Grafft, N. et al. (2023)	1) Having two or more sexual partners (vs. one partner); 2) Not using a condom during sexual intercourse (vs. using a condom)	High school students in grades 9-12 who attended public and private schools and who had ever had sexual intercourse	2005–2019	Youth Risk Behavior Survey	7 U.S. states that had legalized adult-use cannabis; (AK, CA, ME, NV, CO, MI, VT)	U.S. states with no cannabis law (AL, IA, ID, KS, KY, SC, SD, TN, TX, VA, WI, WY)	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Grant, A. et al. (2025)	1) Morphine Milligram Equivalent (MME)/day; 2) Total perioperative MME ; 3) Days of supply	Inpatient TKA or THAs performed between 2017 and 2021 for an indication of osteoarthritis among patients 40 or older with a length of stay <14 days	2017–2021	MarketScan Commercial and Medicare Supplemental Claims and Encounters Database; US Census; US Bureau of Labor Statistics; Prescription Drug Abuse Policy System	7 U.S. states that had legalized adult-use cannabis	States with no cannabis laws (MML nor RML)	DiD
Gunadi, C. (2022)	1) Cannabis-related hospital discharges per 1,000 discharges; 2) Crashes per 100,000 population; 3) Fatal crashes per 1,000 crashes	Colorado residents	2004–2019	Dispensary data: Marijuana Sales Report from Colorado Department of Revenue; Hospital data: Colorado Department of Public Health and Environment; Traffic data: Colorado Department for Transportation; Demographics: Census Bureau statistics; Bureau of Labor Statistics	CO counties with adult-use retail stores	CO counties without adult-use retail stores	DiD and DiD accounting for staggered adoption
Gunadi, C. & Shi, Y. (2022)	Annual cannabis possession arrest rates per 1,000 population at the state level	Youth (<18) and Adults (>18) in 31 states that had previously decriminalized cannabis.	2010–2019	Uniform Crime Reporting Program (UCRP) for U.S. states from the Federal Bureau of Investigation; State level estimates: Integrated Public Use Microdata Series American Community Survey	U.S. states that had legalized adult-use cannabis and had not decriminalized beforehand	U.S. states that had not legalized adult-use cannabis nor decriminalized cannabis during the study period	DiD
Gunadi, C. et al. (2022)	1) Transition from no cannabis use in the past 30 days to any cannabis use	Non-institutionalized children aged 12+	2015–2017	Population Assessment of Tobacco and Health -	CA, MA, ME, NV	U.S. states that had legalized medical cannabis	Propensity score matching

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	in the past 30 days; 2) Transition from no cannabis use in the past 30 days to weekly cannabis use in the past 30 days; 3) Transition from any cannabis use in the past 30 days to no cannabis use in the past 30 days			waves 3 and 4; State level data: US Census Bureau or Bureau of Labor Statistics		use (but not adult use) prior to study period ("MCL" states) U.S. states that had not legalized medical or adult-use cannabis by end of study period ("non-legalizing" states) U.S. states that had not legalized adult-use cannabis ("MCL + non-legalizing" states)	
Hammond, C.J. et al. (2023)	Monthly rate of death by suicide	U.S. individuals aged 12-25 that had died by suicide	2000–2019	National Vital Statistics System Multiple Cause of Death files; Population estimates from Surveillance, Epidemiology and End Results (SEER) program; Covariates: Area Health Resource File and American Community Survey	10 U.S. states and DC that had legalized adult-use cannabis by 2019 (AK, CA, CO, ME, MA, MI, NV, OR, VT, WA)	23 U.S. states that had legalized medical cannabis by 2019 17 U.S. states with no medical or adult-use cannabis laws	DiD accounting for staggered adoption
Hansen, B. et al. (2018)	1) Total alcohol-related traffic fatalities per billion vehicle miles travelled (VMT); 2) Total cannabis-related traffic fatalities per billion VMT; 3) Total number of fatalities per billion VMT	All fatal traffic accidents in CO and WA	2000–2016	Fatal traffic accidents: FARS	CO WA	Synthetic CO Synthetic WA	SCM

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Hansen, B. et al. (2020)	1) The weight of usable cannabis; 2) Total transaction counts; 3) Revenue from cannabis concentrates; 4) Revenue from cannabis edibles; 5) Average price per gram	Cannabis sales in WA	2015–2016	Sales data: Washington's traceability system	After adult-use retail sales in OR	Before adult-use retail sales in OR	Regression discontinuity; Differences-in-discontinuity
Hao, Z. & Cowan, B.W. (2019)	1) Cannabis possession arrests per 10,000 people; 2) Cannabis sale and manufacture arrests per 10,000 people; 3) DUI arrests per 10,000 people; 4) Opium/cocaine possession arrests per 10,000 people	Respondents with cannabis-related arrests in WA, CO, and the six border states.	2009–2014	Uniform Crime Reports (UCR) Program Data: County-level detailed arrest and offense data; Distance to border data: County Distance Database from the National Bureau of Economic Research	Border counties to CO in WY, UT, NM, OK, KS, NE Border counties to WA in ID, OR	Non-border counties in WY, UT, NM, OK, KS, NE Non-border counties in ID, OR	DiD
Harper, A.J. & Jorgensen, C. (2022)	1) Murder rate; 2) Robbery rate; 3) Aggravated assault rate; 4) Burglary rate; 5) Larceny/theft rate; 6) Motor vehicle theft rate	Residents in CO, WA with arrests/offenses	2000–2019	Crime data: Uniform Crime Reports (UCR) Program data. Other data: Federal and government websites, The Giffords Law Center, NORML, and internet searches.	CO, WA (separate)	Donor pool of 40 states that had not legalized adult-use cannabis	SCM
Harris, K.N. & Kulesza, C. (2023)	State-level rates of legal system referrals to treatment for cannabis as the primary substance of use	First-time admissions where cannabis was the primary substance of use	2007–2019	Treatment Episode Data Set - Admissions (TEDS-A); Covariates: U.S. Census, American Community Survey, Kaiser Family Foundation, Department of Justice, Bureau of Justice Statistics	9 U.S. states that had legalized adult-use cannabis by 2019 (AK, CA, CO, ME, MA, MI, NV, VT, WA)	34 U.S. states that had not legalized adult-use cannabis	DiD accounting for staggered adoption

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Hasin, D.S. et al. (2023a)	Clinician-made CUD diagnosis given at one or more outpatient or in-patient encounters within a calendar year	U.S. veterans aged 18 - 75 with one or more VHA primary care, ED or mental health visit in a given year	2005–2019	Veterans' Health Administration electronic health record data; Dispensary data: RAND-USC Opioid Policy Tools and Information Center marijuana policy data	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult use cannabis	DiD accounting for staggered adoption
Hasin, D.S. et al. (2023b)	Clinician assigned cannabis use disorder diagnosis at one or more outpatient or inpatient encounter within a calendar year	Veterans aged 18-75 with one or more primary care, emergency, or mental health visit to the Veterans Health Administration	2005–2019	Veterans' Health Administration electronic health record data; RAND-USC OPTIC marijuana policy data	11 U.S. states and DC that had legalized adult-use cannabis (AK, CA, CO, ME, MA, MI, IL, OR NV, VT, WA) 8 U.S. states that had adult-use cannabis retail stores in operation (AK, CA, CO, ME, MI, OR NV, WA)	U.S. states with medical cannabis laws (but not adult use) U.S. states with medical cannabis retail stores	DiD accounting for staggered adoption
Hathaway, A.D. et al. (2021)	Whether respondents had purchased cannabis illegally through a dealer	Canadians aged 15 and older living in the 10 provinces (excluding those living on indigenous reserves, institutionalized persons and those experiencing homelessness)	2018–2019	National Cannabis Survey	Ontario, Quebec, Manitoba, Saskatchewan, Alberta, British Columbia	Atlantic provinces	Natural experiment: regression analyses
Hobin, E. et al. (2023)	Monthly or more frequent use of both cannabis and alcohol in the past 12 months	Respondents aged 16-65	2018–2019	International Cannabis Policy Study	Canada	U.S. states that had legalized adult-use cannabis	Natural experiment: regression analyses

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Hodge, T.R. & Hazel, C. (2022)	Log food sales per capita of 1) Taxable food; 2) Non-taxable food; 3) Restaurant food	WA respondents	2012–2016	Food data: State of Washington's Department of Revenue's data on quarterly food sales for Food and Beverage Stores and Food Services and Drinking Places, and Food and Beverage Stores. Cannabis data: Washington State Liquor and Cannabis Board	WA counties that had adult-use retail stores	U.S. states that had not legalized adult-use cannabis	A panel event study design; DiD and DiD accounting for staggered adoption
						WA counties that did not have adult-use retail stores ('Not yet treated' and 'never treated')	
						WA counties that did not have adult-use retail stores but would by 2016 ('Not yet treated')	
Hollingsworth, A. et al. (2022)	1) Past-year cannabis use; 2) Past-month cannabis use; 3) Cannabis initiation in the past 2 years; 4) Past-month alcohol use; 5) Past-month tobacco use; 6) Past-month cocaine use; 7) Log positivity rate of workplace drug tests of THC; 8) Adult and juvenile possession arrests; 9) Adult and juvenile sale arrests	Non-institutionalized U.S. residents aged 12+	2002–2017	Cannabis data: NSDUH; Non-survey cannabis data: Quest diagnostics, UCR program data. Policy data: National Alliance for Model State Drug Laws, ProCon, and individual laws; Demographic: Bureau of Labor Statistics, Surveillance Epidemiology and End Results Project	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use cannabis	Event study design and DiD
					U.S. states that had adult-use stores	U.S. states that did not have adult use stores	

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Horak, B. & Frei, C. (2023)	1) log cash spending; 2) log e-Transfer spending	Retail transactions (non-business, non-government) from cannabis consumers and non-consumers	2018–2019	Banking data: ATB Financial; License data: Cannabis stores from AGLC	Cannabis consumers (i.e., purchased cannabis once legal)	Non-consumers	DiD
Hsu, G. & Kovacs, B. (2021)	1) Log transformed age adjusted death rate from opioids per 100,000; 2) log-transformed age-adjusted death rate from prescription opioids per 100,000; 3) log-transformed age-adjusted death rate from heroin per 100,000; 4) log-transformed age-adjusted death rate from synthetic non-methadone per 100,000	Residents aged 21+ that suffered a fatal opioid overdose	2015–2018	Mortality data: Centers for Disease Control and Prevention, U.S. Census data; Cannabis store data: Prescription Drug Abuse Policy System, media reports, online government resource, Weedmaps; Demographics: American Community Survey	Counties with greater number of adult-use retail stores	Fewer number (or zero) of adult-use retail stores Fewer number (or zero) of adult-use retail stores including those in states without adult-use cannabis legalization	Natural experiment: regression analyses
Hughes, L.A. et al. (2020)	1) Total count of violent offenses; 2) Total count of property offenses; 3) Total count of drugs and alcohol offenses; 4) Total count of disorder offenses	Residents in Denver, CO with an offense	2012–2015	Crime data: Uniform Crime Reports and National Incident Based Reporting System; Store data: City and County of Denver's Office of Marijuana Policy, Denver Excise and License Director, Secretary of State, and the Department of Revenue's Marijuana Enforcement; Neighborhood disadvantage: American Community Survey	Neighborhoods in Denver, CO, that have opened an adult-use retail store	Neighborhoods in Denver, CO, that have not opened an adult-use retail store	Natural experiment: regression analyses

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Jameson, M. et al. (2023)	1) Quantity of cannabis purchased per 10,000 county population; 2) Standard deviation of reported price by county-month; 3) proportion of poor-quality cannabis purchases	Residents who self-report cannabis price indicators to PriceOfWeed	2012–2013	PriceOfWeed.com; County-level demographics: American Community Survey, Tax Foundation, Energy Information Administration Data	CO, WA	U.S. states that had not legalized adult-use cannabis	DiD
Jayawardhana, J. & Fernandez, J. (2024)	1) Inpatient visit rate for asthma per 100,000 population per quarter; 2) Inpatient visit rate for asthma by payer-type per 100,000 enrollees per quarter	Inpatient visits for asthma by all payer adult patients aged 19 and above in 38 states	2005–2017	Healthcare Cost and Utilization Project (HCUP) Fast Stats database; Covariates: US Census Bureau; US Bureau of Labor Statistics; Kaiser Family Foundation website; Behavioral Risk Factor Surveillance System; Air Quality Index data from the US Environmental Protection Agency; RAND-USC Schaeffer Opioid Policy Tools and Information Center	7 U.S. states that had legalized adult-use cannabis; (AK, CA, ME, NV, CO, MI, VT)	All other states	Event study design and DiD and DiD accounting for staggered adoption
Jayawardhana, J. et al. (2024)	1) Cannabis use disorder diagnoses per 100,000 enrollees; 2) Cannabis poisoning diagnoses per 100,000 enrollees	Adults aged 18 to 64 years with 1 year or longer of insurance enrollment	2011–2021	Merative MarketScan Commercial Claims and Encounters Database, Rand-University of Southern California Schaeffer Opioid Policy Tools and Information Center, Network for Public Health Law, The Kaiser Family	U.S. states that had legalized adult use cannabis	All other states	DiD accounting for staggered adoption

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
				Foundation, US Census Bureau, US Bureau of Labor Statistics, and Tax Policy Center of the Urban Institute and Brookings Institute			
Jiang, S. & Miller, K. (2022)	1) log of the number of establishments; 2) log of the total number of workers; 3) log of the total real quarterly wages ; 4) log of the average weekly real wage per worker	CO, WA residents in labor markets	2000–2019	Employment data: Quarterly Census of Employment and Wages; State-level demographic data: U.S. Census Bureau; Agricultural data: National Agricultural Statistics Service	CO, WA (separate)	Donor pool of non-treated states	DiD with SCM
Jorgensen, C. & Harper, A.J. (2020)	1) Index violent crime clearance rates (homicide, rape, robbery, aggravated assault); 2) Index property crime clearance rates (burglary, larceny-theft, motor vehicle theft, arson)	CO, WA residents with clearance rates	2000–2017	Clearance rates: FBI 43502 document; Cannabis laws: government websites	CO, WA (separate)	For CO: Donor pool of non-treated states (AL, CT, KS, LA, NJ, VT, WV) Donor pool of non-treated states (NH, ND, OK, RI, TN, WV, WY) For WA: Donor pool of non-treated states (AR, MI, MN, NE, OH, RI, SC, VT) Donor pool of non-treated states (AR, IN, KS, MS, OK, RI, TX)	SCM
Kamer, R.S. et al. (2020)	Traffic fatalities per billion vehicle miles traveled (BVMT)	Residents who had suffered a fatal traffic collision	2008–2012; 2016–2018	Traffic fatality data: National Highway Traffic Safety	CO, WA, OR, AK	20 U.S. states that did not legalize medical	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Kerr, D.C.R. et al. (2018)	1) Past month cannabis use; 2) Past month tobacco use; 3) Past month alcohol use; 4) Past month illicit drug use (cocaine, methamphetamine, amphetamines, sedatives, hallucinogens, anabolic steroids, opiates, inhalants, MDMA, other club drugs, other illegal drugs); 5) Frequent cannabis use (>20 days)	Undergraduates (18-26) from 4-year institutions that participated in the National College Health Assessment-II Surveys before and after Oregon's legalization	2008–2016	Administration's Fatality Analysis Reporting System National College Health Assessment-II Survey	4-year institutions in OR	or adult-use cannabis as of 2018 4-year institutions in U.S. states without adult-use cannabis laws	Natural experiment: regression analyses
Kerr, D.C.R. et al. (2023)	1) Past month cannabis use; 2) Past month frequent use (>20 days); 3) Past month frequent alcohol use; 4) Past month binge drinking (>= 5 drinks on one occasion); 5) Past year CUD (>= 2 of the 9 DSM-5 criteria)	Non-institutionalized college-eligible participants aged 18-23 (i.e., no longer enrolled in high school and not graduated college)	2008–2019	NSDUH	U.S. states that had legalized adult-use cannabis by 2019; Does not provide specific states	U.S. states without any medical or adult-use law; Does not provide specific states	Natural experiment: regression analyses
Kilmer, B. et al. (2022)	Number of per capita traffic crashes	Residents aged 18 and older	2013–2019	National Unit of Road Safety; Demographics: Continuous Household Survey of the National Statistics Institute; Alcohol: Vehicle Revenue Collection System	Greater numbers of: Growers; Members; Purchasers	Lower numbers of: Growers; Members; Purchasers	Natural experiment: ecological study
Kim, J.H. et al. (2021)	1) Past month poly use of cannabis and alcohol; 2) Past month use of cannabis (no alcohol); 3)	Non-institutionalized residents aged 12+	2004–2017	NSDUH	U.S. states that had legalized adult-use cannabis	U.S. states that had not changed their cannabis laws between 2004-2017	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Kim, C. et al. (2022)	Past month use of alcohol (no cannabis)	Ontario residents aged 18+ eligible for provincial universal health insurance with continuous coverage from 2015-2021	2015–2021	Health administrative data from Institute for Clinical Evaluative Sciences - National Ambulatory Care Reporting System, Discharge Abstract Database, and Ontario Mental Health Reporting System	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
	Monthly cannabis-attributable ED visits (includes cannabis-related disorders and cannabis poisonings)				Post-legalization (Phase 2)	Pre-legalization (Phase 2)	
Kim, C. et al. (2023)	Monthly cannabis-related ED visits (defined as any mental and behavioral disorders and poisonings due to cannabis use)	Adults (18+) eligible for Ontario Health Insurance Plan and had continuous coverage from 2015 to 2021	2015–2021	Health administrative data from Institute for Clinical Evaluative Sciences - National Ambulatory Care Reporting System	Post-legalization	Pre-legalization	C-ITSA
Kim, C. et al. (2024)	Cannabis-related hospitalizations (F12 and T40.7)	Adults in Alberta hospitalized with a cannabis-related diagnosis	2015–2021	Data from Alberta Health Services	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
					Post-legalization (Phase 2)	Pre-legalization (Phase 2)	
Kim, C. et al. (2024)	1) Cannabis-related ED visits; 2) Mental health-related ED visits; 3) Cannabis and psychosis-related ED visits	Adult patients eligible for provincial universal healthcare (OHIP) diagnosed with schizophrenia	2015–2021	Institute for Clinical Evaluative Sciences (ICES)	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
	Annual number of synthetic cannabis exposures	Synthetic poisonings in the US	2016–2019	National Poison Data System data; Cannabis law: National Conference of State Legislatures; State data: Americans for Safe Access reports	Post-legalization (Phase 2)		Natural experiment: regression analyses
					U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized medical or adult-use cannabis	

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Lane, T.J. & Hall, W. (2019)	Monthly traffic fatalities rates per million residents	Traffic fatalities in the U.S.	2009–2016	Mortality data: Centers for Disease Control and Prevention's Wide-Ranging Online Data for Epidemiologic Research (CDC WONDER) and RoadSafetyBC; Population data: US and BC Census	CO, WA, OR and their neighboring states CO, WA, OR Neighboring states to CO, WA, OR	U.S. states that did not change cannabis laws between 2009–2016	C-ITSA
Laqueur, H. et al. (2020)	1) Past year cannabis use; 2) Past month cannabis use; 3) Frequent cannabis use (more than 10 days in past month); 4) Perceived risk (% great or moderate risk); 5) Perceived availability (% easy or very easy to obtain)	8th, 10th, and 12th grade students (ages 12–21) in urban regions of Uruguay and Chile	2014–2018 2015–2018	National Drug Observatories; Covariate data: National Socioeconomic Characterization Survey 9CASEN) and Continuous Household Survey	Montevideo and regions in the interior of Uruguay	Combination of 15 regions in Chile	SCM
Lara, L.F. et al. (2022)	1) Hospitalization for acute pancreatitis; 2) Hospitalization for severe acute pancreatitis	Adult aged 18+ hospitalized with acute pancreatitis or severe acute pancreatitis	2011, 2015	State Inpatient databases: Healthcare Cost and Utilization National Inpatient Sample database Project (HCUP)	CO, WA	AZ, FL	Natural experiment: regression analyses
Lee, M.H. et al. (2022)	1) Lifetime use of cannabis; 2) Past month cannabis use	9th to 12th grade students	2009–2019	Youth Risk Behavior Survey	AK	HI	DiD
Lee, S. (2024)	Recidivism (returning to prison within one year after release)	Ex-offenders who were convicted of sentences from 5 states that legalized RML and 35 states that did not.	2006–2019	National Corrections Reporting Program (NCRP)	5 U.S. states that legalized adult-use cannabis (CO, ME, MA, NV, WA)	35 U.S. states that did not legalize adult-use cannabis	DiD
Li, L. et al. (2024)	1) Natural log of workplace injuries per 100 full-time equivalent workers; 2)	U.S. adults in work aged 20–34	2006–2020	Bureau of Labor Statistics Survey of	13 U.S. states that had legalized	All other states	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	Natural log of workplace injuries per 100 persons			Occupational Injuries and Illnesses	adult-use cannabis 10 U.S. states that permitted adult-use retail sales 3 U.S. states that did not permit adult-use retail sales but had legalized		
Liu, Y. et al. (2025)	1) Illicit drug mortality; 2) Cannabis initiation (people who initiated cannabis in states and every 2 years); 3) Cannabis use; 4) Illicit drug initiation (people who initiated illegal drugs in state and every 2 years); 5) Illicit drug use (people who use illegal drugs in state and every 2 years); 6) Bitcoin transactions	U.S. adults	January 2012–December 2018	Centers for Disease Control and Prevention (CDC), National Survey on Drug Use and Health (NSDUH), Treatment Episode Data Set: Admissions (TEDS-A), state-level DEA drug seizures, state-level PDMP, Prescription Drug Abuse Policy System (PDAPS), and American Community Survey (ACS)	11 U.S. jurisdictions that had legalized adult use cannabis	All other states	DiD
Lockwood, J. et al. (2019)	1) NICU admission; 2) Small for gestational age births (birth weight <10th percentile for completed gestational age in weeks)	Births to mothers with residence in CO	2012–2016	Colorado Birth Dataset from the Colorado Department of Public Health and Environment Vital Statistics Program; Retail store data: Colorado State Demographic Office and Colorado	After adult-use cannabis retail stores in CO	Before adult-use cannabis retail stores in CO	ITSA

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Lu, R. et al. (2021)	1) Violent crime rate per 100,000 people (violent crime includes murder, manslaughter, aggravated assault, rape and robbery); 2) Property crime per 100,000 people (property crime includes auto theft, burglary, and larceny); 3) Aggravated assault rate per 100,000; 4) Auto theft rate per 100,000; 5) Burglary rate per 100,000; 6) Larceny rate per 100,000; 7) Robbery rate per 100,000	Residents with arrests or clearance data in relevant states	1996–2016	Department of Public Safety Uniform Crime Reporting Program Data: Offenses Known and Clearances by Arrest data.	CO (pre/post legalization) CO (pre/post retail sales) WA (pre/post legalization) WA (pre/post retail sales)	21 control states that had not legalized adult-use or medical cannabis	C-ITSA
Lu, T. et al. (2021)	1) Total food spending in past 3 months in 2019 dollars; 2) Food at home spending in past 3 months in 2019 dollars ; 3) Food away from home spending in past 3 months in 2019 dollars ; 4) Alcohol spending in past 3 months in 2019 dollars	U.S. residents	2005–2019	Household expenditure data from the Consumer Expenditure Interview Survey	U.S. states that legalized adult-use cannabis U.S. states that had legalized adult-use cannabis and opened retail stores	U.S. states that did not legalize adult-use cannabis by 2019	DiD
Macha, V. et al. (2022)	1) Any alcohol consumption in last month; 2) Binge drinking (5 or more drinks for men and 4 or more drinks for women on a single occasion during past month; 3) Heavy drinking (more than 14 drinks per week for men and more than 7 drinks per week for women)	U.S. adult residents aged 18+	2010–2019	Alcohol use and demographics: Behavioral Risk Factor Surveillance System (BRFSS); Cannabis law: RAND Opioid Policy Tools and Information Center; Beer and tobacco tax: US National Institute on Drug Abuse and the	U.S. states that had legalized adult-use cannabis	U.S. state that had not legalized adult-use cannabis	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
				Centers for Disease Control and Prevention			
Macleaen, J.C. et al. (2021)	Rates of all disability applications and allowances (all claims: SSDI and SSI) per 10,000 eligible adults	Disability applications and allowances for non-elderly adults	2001–2019	SSA State Agency Monthly Workload Data (SAMWD); US Census and Current Population Survey	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use cannabis	DiD
					U.S. states with adult-use retail stores	U.S. states without adult-use retail stores	
Makin, D.A. et al. (2019)	Monthly totals of Part I violent and property crime clearance rates: 1) Violent crime; 2) Property crime; 3) Rape; 4) Robbery; 5) Aggravated assault; 6) Burglary; 7) Larceny; 8) Motor vehicle theft	Police clearances	2010–2015	Uniform Crime Reporting (UCR) program	CO, WA (separate)	All other U.S. states	Multi-group ITSA
Makin, D.A. et al. (2021)	Number of officer- and dispatch-initiated calls for service	All officer- and dispatch-initiated calls for service in Pullman, WA, and Moscow, ID	2005–2016	Electronic records of Pullman and Moscow police departments	City of Pullman, WA, post-legalization	City of Pullman, WA, pre-legalization	ITSA
					City of Moscow, ID, post-legalization in WA	City of Moscow, ID, pre-legalization in WA	
March, R.J. et al. (2022)	Obesity rate as a percentage of the population	Representative sample of adult U.S. residents	2003–2018	State of Childhood Obesity dataset, using data from the Behavioral Risk Factor Surveillance System (BRFSS); US Census Bureau; SNAP State Activity Reports; CDC Center for Health Statistics; Kaiser Family Foundation's State	WA	Synthetic WA	SCM

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
				Health Facts; Bureau of Labor Statistics			
Marinello, S. & Powell, L.M. (2023)	1) Motor vehicle accidents; 2) Suicide; 3) Opioid overdose	U.S. residents that had died of a motor vehicle accident, suicide or an opioid overdose between 2009 and 2019	2009–2019	Multiple Cause of Death Research Files from the National Center for Health Statistics' Division of Vital Statistics	7 U.S. states with adult-use retail markets implemented prior to 2019	U.S. states with comprehensive medical cannabis programs	DiD
Marinello, S. (2025)	1) Past year use; 2) Initiation of cannabis	Non-institutionalized individuals aged 12+	2002–2019	National Survey on Drug Use and Health; American Community Survey	5 U.S. states that had implemented adult-use markets pre-2018 (CO, WA, OR, AK, NV)	Donor pool of U.S. states that had medical cannabis laws but did not legalize adult-use cannabis during study period	SCM with staggered treatment adoption
Martinez, P. et al. (2024)	Incidence rate of cannabis-related disorders diagnoses per 100,000 population	Individuals aged 15+ in Quebec who received diagnoses of interest for the first time	2010–2022	Quebec Integrated Chronic Disease Surveillance System; Age/sex: Canadian Census data	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
Martins, S.S. et al (2021)	1) Past year cannabis use; 2) Past month cannabis use; 3) Past month daily cannabis use (20+ days) among people with past month cannabis use; 4) Past year CUD among people with past year cannabis use	Non-institutionalized individuals aged 12+	2008–2017	NSDUH; Policy data: Marijuana Policy Project, ProCon	U.S states that had legalized adult-use cannabis	U.S. states with medical cannabis laws but not adult-use cannabis laws	Natural experiment: "Method similar to DiD"
Martins, S.S. et al. (2025)	1) Past year opioid misuse; 2) Past month opioid misuse; 3) Past year opioid use disorder	Noninstitutionalized civilian population aged 12 years or older	2015–2019	NSDUH	U.S. states that had legalized adult use cannabis	U.S. states with medical cannabis laws	Natural experiment: regression analyses
Masonbrink, A.R. et al. (2021)	Annual incidence of an adolescent (11-17) hospitalization (inpatient admission to a hospital for	Adolescent (11-17) hospitalizations at children's hospitals	2008–2019	Inpatient Essentials database	U.S. states that had legalized adult-use cannabis	U.S. states that had legalized medical cannabis use (but not adult	ITSA, DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	any reason; no ED or outpatient visits were included) with a cannabis-related diagnosis					use) prior to study period	
Mathur, N.K. & Ruhm, C.J. (2023)	Opioid deaths	Deaths from opioids in the U.S.	1999–2019	National Vital Statistics System; Policy data: RAND-OPTIC	U.S. states that had legalized adult-use cannabis U.S. states with adult-use retail stores	U.S. states with no cannabis law	DiD
Matthay, E.C. et al (2021)	1) Rate of claims of one or more health insurance claims during a single day for the treatment of injuries with an ICD code indicating self-harm or assault	Individuals of all ages eligible for the insurance product for at least one month and residing in the U.S.	2003–2017	Commercial and Medicare Advantage claims: Clinformatics Data Mart. Covariates: Alcohol Policy Information System, Census Bureau, Bureau of Labor Statistics	U.S. states that had legalized adult-use cannabis but did not have retail stores U.S. states with adult-use retail stores	U.S. states with no cannabis law	Natural experiment: regression analyses
Matthay, E.C. et al (2024)	Harmful exposures involving minor, moderate and severe medical outcomes	Exposures to cannabis reported to California Poison Control System	2011–2020	California Poison Control System	Localities without adult use retail store ban More permissive localities according to adult-use policy scores (continuous) Localities adopting packaging and labelling requirements	Localities with adult-use retail store ban More restrictive localities according to adult-use policy scores (continuous) Localities not adoption packaging and labelling requirements	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Mauro, P.M. et al. (2024)	Past-year specialty CUD treatment	Non-institutionalized individuals aged 12+ in the U.S. who needed CUD treatment (defined as meeting past-year DSM-5-proxy CUD criteria)	2004–2019	National Survey on Drug Use and Health	U.S. jurisdictions that had legalized adult-use cannabis	U.S. states that had legalized medical cannabis but not adult use. U.S. states that had not legalized medical nor adult use cannabis U.S. states that did not have medical cannabis laws	Natural experiment: regression analyses
McCarthy, S.D.S. et al. (2024)	1) Anxiety disorder ED visits; 2) Anxiety and cannabis ED visits per capita; 3) Anxiety and alcohol ED visits per capita	Residents of Ontario aged 10-105	2008–2022	Institute for Clinical Evaluative Science (IC/ES)	Post-legalization (Phase 1) Post-legalization (Phase 2)	Pre-legalization (Phase 1) Pre-legalization (Phase 2)	ITSA
McDonald, A.J. et al. (2024)	Opioid-related mortality rate per 1,000,000	Opioid mortality in Canada, Ontario and BC	2018–2023	Statistics Canada, British Columbia Centre for Disease Control, Interactive Opioid Tool at Public Health Ontario, Public Health Agency of Canada	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
McDonald, A.J. et al. (2025)	Quarterly household expenditures on 1) medical cannabis; 2) illegal cannabis; 3) total cannabis [illegal + medical + licensed]	All Canadian expenditures for cannabis	2001–2023	Statistics Canada for licensed expenditures. Health Canada for medical expenditures. Canadian Community Health Survey, Canadian Tobacco, Alcohol and Drugs Survey, and National Cannabis Survey for illegal expenditures.	Post-law passage Post-legalization (Phase 1) Post-legalization (Phase 2)	Pre-law passage Pre-legalization (Phase 1) Pre-legalization (Phase 2)	ITSA

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
McMichael, B.J. et al. (2020)	1) Total number of MMEs prescribed by each provider (log-transformed); 2) Total days' supply prescribed by each provider (log-transformed); 3) Number of unique patients to whom each provider prescribed opioids (log-transformed); 4) Percentage of a providers patients receiving any opioids (log-transformed); 5) Whether a provider prescribed any opioids	Individual prescriptions filled by patients at outpatient pharmacies (private and public payers).	2011–2018	Cannabis data: previous research, Westlaw database; Opioid data: Symphony Health's IDV (Integrated Davaverse) dataset; PDMP Training and Technical Assistance Center (PDMP TTAC)	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use or medical cannabis	DiD
Meehan, B. et al. (2020)	1) Number of hotel rooms rented in each state in a given month (log-transformed); 2) Average daily room rate of hotel rooms rented in each state in a given month (log-transformed); 3) Total hotel revenue in each state in a given month (log-transformed)	Tourism industry in contiguous states	2011–2015	Monthly hotel occupancy data	CO, WA (separate)	U.S. states that had not legalized adult-use cannabis U.S. states that did not have adult-use stores	DiD
Meier, M.H. et al. (2023)	1) Number of registered medical cannabis patients each month. 2) Daily number of medical cannabis dispensary transactions; 3) Daily amount of medical cannabis sold	Medical cannabis sales and registration in Arizona's licensed dispensaries	2018–2021	Arizona Department of Health Services monthly reports on the medical cannabis program; Numeric values from sales figures using the WebPlotDigitizer	Post-legalization in AZ After adult-use retail sales in AZ	Pre-legalization in AZ Before adult-use retail sales in AZ	ITSA
Meinhofer, A. et al. (2021)	Proportion of maternal hospitalizations involving substance use disorders; 1) Cannabis use disorder; 2) Opioid use disorder; 3)	Maternal health in the 34 states	2007–2018	Discharge data: Healthcare Cost and Utilization Project state inpatient databases (HCUP-	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use cannabis	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	Stimulant use disorder; 4) Drug complications; 5) Alcohol use disorder; 6) Tobacco use disorder; 7) Drug use disorder; 8) Substance use disorder. Newborn health: 9) Exposure to noxious substances; 10) Neonatal drug withdrawal; 11) Fetal alcohol syndrome; 13) Slow growth; 14) Respiration condition; 15) Feeding problem; 16) Congenital anomalies; 17) Low gestational			SID); National Vital Statistics System Nativity Files (NVSS Natality)	U.S. states that had adult-use stores	U.S. states that did not have adult-use stores	
Meinhofer, A. & Rubli, A. (2021)	1) Price per gram of cannabis in dollars (natural log); 2) Price per gram of illegal drugs in dollars (natural log); 3) Potency of illegal drugs (natural log); 4) Potency-adjusted price per gram (natural log); 5) Self-reported price per milligram in dollars of illegal prescription drugs (natural log); 6) Law enforcement submissions of illegal drugs per 100,000 people (natural log)	Illegal drug purchases and prices in US	2010–2019	Price of Weed; StreetRx; System to Retrieve Information from Drug Evidence (STRIDE); National Forensic Laboratory Information System (NFLIS)	U.S. states that had legalized adult-use cannabis U.S. states that had adult-use stores	U.S. states that had not legalized adult-use cannabis U.S. states that did not have adult-use stores	DiD
Meize, M.R. et al. (2022)	1) Total monthly cannabis arrest rates (sales, possession, business-related offenses) for adult women; 2) Monthly cannabis possession arrest rates for adult women	Arrests among adult women (21+) in CO	2010–2016	National Incident-Based Reporting System (NIBRS)	Post-legalization in CO	Pre-legalization in CO	ITSA

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Mennis, J. & Stahler, G.J. (2020)	Adolescent substance use disorder treatment admissions for cannabis use	Youth treatment admissions for cannabis - aged 12-17	2008–2017	SAMHSA Treatment Episode Dataset - Admissions (TEDS-A); Covariates: American Community Survey	CO, WA	U.S. states that had not legalized adult-use cannabis (and did not have missing data)	DiD
Mennis, J. et al. (2021)	Rates of treatment admissions for: 1) Cocaine; 2) Opioids; 3) Methamphetamine	Individuals in treatment for cocaine, opioids and methamphetamine between 12 and 24	2008–2017	SAMHSA Treatment Episode Dataset - Admissions (TEDS-A); Covariates: American Community Survey	CO, WA	U.S. states that had not legalized adult-use cannabis (and did not have missing data)	DiD
Mennis, J. et al. (2023a)	1) Perception of risk when smoking cannabis once a month; 2) Past month cannabis use; 3) CUD treatment admissions per 10,000 adolescents or young adults	Youth (12-17) and young adults (18-24)	2008–2019	SAMHSA Treatment Episode Dataset - Admissions (TEDS-A); NSDUH	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use cannabis	DiD
Mennis, J. et al. (2023b)	The relationship between past month cannabis use and past year report of a major depressive episode	Non-institutionalized individuals aged 18-25	2008–2019	NSDUH	10 U.S. states that had legalized adult-use cannabis by 2019 (AK, CA, CO, ME, MA, MI, NV, OR, VT, WA)	All other states	DiD
Mennis, J. et al. (2023c)	Proportion of criminal justice referrals to treatment for cannabis	Youth (12-17) and young adults (18-24)	2008–2019	Treatment Episode Dataset - Admissions (TED-A)	10 U.S. states that had legalized adult-use cannabis by 2019 (AK, CA, CO, ME, MA, MI, NV, OR, VT, WA)	All other states	DiD
Mennis, J. et al. (2024)	CUD treatment admission rate (total number of adolescent CUD treatment admission per 10,000 resident adolescents)	Adolescents aged 12-17 referred to treatment (but not referred from the CJS)	2008–2019	National Survey on Drug Use and Health; Treatment Episode Dataset - Admissions	US states that had legalized cannabis	All other states (controlling for medical cannabis laws)	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Merrill, R.M. et al. (2024)	Physical activity in the past 30 days	U.S. adults	2016–2022	Behavior Risk Factor Surveillance System (BRFSS)	Cannabis use in the past 30 days U.S. states that had legalized adult-use cannabis Chronic medical condition	No cannabis use in the past 30 days U.S. states that had not legalized adult-use cannabis No chronic medical condition	Natural experiment: regression analyses
Miller, K. & Seo, B. (2021)	Log of quantity sold: 1) Beer sales; 2) Liquor sales; 3) Wine sales; 4) Cigarette sales; 5) Other tobacco products (OTP) sales; 6) Changes in alcohol product's share of total spending on alcohol ; 7) Changes in tobacco product's share of total spending on tobacco; 8) Changes in total spending on alcohol ; 9) Changes in total spending on tobacco	Alcohol and tobacco sales in WA	2013–2016	Cannabis sales: Washington State Liquor and Cannabis Board (WSLCB); Tobacco and alcohol sales: Nielsen Retail Scanner Dataset	WA counties that had adult-use retail stores	WA counties that did not have adult-use retail stores	DiD
Mital, S. et al. (2024)	1) Monthly beer sales (hectoliters per 100,000 population); 2) Monthly spirit sales (hectoliters per 100,000 population)	Beer and spirit sales in the 10 provinces of Canada	2012–2020	Beer Canada; Statistics Canada	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
Montgomery, B.W. et al. (2022)	Newly incident cannabis use	Non-institutionalized U.S. residents aged 12+	2008–2019	NSDUH	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use cannabis	Event study analyses; DiD
Myran, D.T. et al, (2022a)	1) Primary outcome: Monthly cannabis hyperemesis syndrome ED visits per 100,000; Secondary outcomes: ; 2)	Ontario residents aged 15-105 who were eligible for the province's single-	2014–2021	Hospital administrative data	Post-legalization (phase 1) Post-legalization (Phase 2)	Pre-legalization (phase 1) Pre-legalization (Phase 2)	ITSA

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	All cause ED visits ; 3) All cause vomiting visits ; 4) Mental health ED visits ; 5) Substance use visits	payer universal health insurance					
Myran, D.T. et al, (2022b)	1) Monthly rates of cannabis-attributable ED visits per 100,000; 2) Monthly rates of cannabis-attributable ED visits per 1,000 all-cause ED visits	Ontario residents aged 15-105 who were eligible for the province's single-payer universal health insurance	2016–2021	ED visits: Ontario administrative dataset from Institute for Clinical Evaluative Sciences; National Ambulatory Care Reporting System; Registered Person Database; Cannabis: Statistics Canada	Post-legalization (phase 1) Post-legalization (Phase 2)	Pre-legalization (phase 1) Pre-legalization (Phase 2)	ITSA
Myran, D.T. et al. (2023a)	Proportion of hospitalizations among children 0-9 due to cannabis poisoning out of all-cause poisoning hospitalizations	Hospitalizations in children aged 0-9 due to cannabis in four provinces	2015–2021	Hospital data: CIHI Discharge Abstract Database (ON, BC, AB) and RAMQ Maintenance and Use of Data for the Study of Hospital Clientele database (QC). Sales data: Statistics Canada	Post-legalization (phase 1) Post-legalization (Phase 2)	Pre-legalization (phase 1) Pre-legalization (Phase 2)	ITSA
Myran, D.T. et al. (2023b)	1) Rate of hospitalizations due to cannabis per capita (100,000); 2) Rate of hospitalizations due to cannabis per 1,000 all-cause hospitalizations	Hospitalization from individuals aged 15 to 105 who were eligible for the province's single-payer universal health insurance	2015–2021	Canadian Institute of Health Informatics - Discharge Abstract Database and the Hospital Morbidity Database	Post-legalization (Phase 1) Post retail expansion in Ontario (aligning with Phase 2)	Pre-legalization (Phase 1) Pre retail expansion in Ontario, but post-legalization (aligning with Phase 2)	ITSA
Myran, D.T. et al. (2023c)	1) Rate of ED visits for a traffic injury that was positive for cannabis involvement per 1000 traffic injury ED visits; 2) Rate of ED visits for a	Individuals aged 16 and older that were eligible for Ontario's Universal Health Coverage	2010–2021	National Ambulatory Care Reporting System (NACRS); Discharge Abstract Database; Ontario Mental Health	Post-legalization (Phase 1) Post retail expansion in	Pre-legalization (Phase 1) Pre retail expansion in Ontario, but post-	ITSA

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	traffic injury that was positive for alcohol involvement per 1000 traffic injury ED visits; 3) Rate of ED visits for a traffic injury that was positive for cannabis and alcohol involvement per 1000 traffic injury ED visits			Reporting System Metadata ; MOMBABY ; OHIP Claims Database ; Registered Persons Database ; Postal Code Conversion File	Ontario (aligning with Phase 2)	legalization (aligning with Phase 2)	
Myran, D.T. et al. (2023d)	Primary 1) Acute care visits (either an ED visit or admission to hospital) related to cannabis use (including cannabis derivatives) during pregnancy per 100,000 pregnant people; Control outcomes; 2) Acute care visits for cannabis use per 100 pregnant people receiving acute care for a mental health disorder; 3) Acute care visits for cannabis use per 100 pregnant people receiving acute care for substance use (including cannabis)	Pregnancies in Ontario (including live births, stillbirths, miscarriages or induced abortions) between the ages of 10 and 55	2015–2021	National Ambulatory Care Reporting System (NACRS); Discharge Abstract Database; Ontario Mental Health Reporting System Metadata; MOMBABY; OHIP Claims Database; Registered Persons Database; Postal Code Conversion File	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
Myran, D.T. et al. (2023e)	Primary; 1) Monthly count of ED visits for cannabis-induced psychosis (any); 2) Monthly count of ED visits for first presentation of cannabis-induced psychosis; Control outcomes; 3) Monthly count of ED visits for cocaine-induced psychosis; 4) Monthly count of ED visits for	Individuals aged 15–105 who were eligible for Ontario's Health Insurance Plan (OHIP)	2014–2021	National Ambulatory Care Reporting System (NACRS); Discharge Abstract Database; Ontario Mental Health Reporting System Metadata; MOMBABY; OHIP Claims Database; Registered Persons Database; Postal Code Conversion File	Post-legalization (Phase 1) Post retail expansion in Ontario (aligning with Phase 2)	Pre-legalization (Phase 1) Pre retail expansion in Ontario, but post-legalization (aligning with Phase 2)	ITSA

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Myran, D.T. et al. (2024)	methamphetamine-induced psychosis 1) Monthly rates of overall self-harm ED visits.; 2) Monthly rates of self-harm ED visits with cannabis-involved ED visits; 3) Monthly rates of self-harm ED visits with alcohol-involved ED visits	Ontario residents aged 10+ and eligible for the province's universal health care coverage	2010–2021	Authors used 7 linked datasets but did not specify which ones.	Post-legalization (phase 1) Post-legalization (Phase 2)	Pre-legalization (phase 1) Pre-legalization (Phase 2)	ITSA
Myran, D.T. et al. (2025)	1) First onset of schizophrenia based on a medical record-validated algorithm; 2) Schizophrenia and additional codes for psychotic disorder not otherwise specified	People aged 14-65 without a history of schizophrenia and eligible for Ontario's single-payer universal health system	2006–2022	Health administrative data from Ontario for the Ontario Health Insurance Plan - there were 7 individual-level datasets that are not named in the article.	Post legalization (Phase 1)	Pre legalization (Phase 1)	ITSA
Nayeem, N. et al. (2025)	Age-adjusted suicide rate (deaths per 100,000)	Age-adjusted suicide rates in the U.S.	2000–2022	Centers for Disease Control and Prevention's (CDC) Multiple Cause of Death Files; NORML; Federal Reserve Economic Data (FRED); Tax Policy Center	U.S. states that had legalized adult-use cannabis (24 by 2022)	All other states	DiD
Nazif-Munoz, J.I. et al. (2020)	Weekly traffic fatality rate of light motor vehicle drivers and motorcyclists per type of vehicle	Traffic fatalities of different vehicles	2012–2017	National Road Safety Agency of Uruguay and the Ministry of Transport and Public Works,	Post-legalization	Pre-legalization	ITSA
Nazif-Munoz, J.I. et al. (2023)	1) Daily numbers of crashes per 1M population; 2) Daily number of all road users' victims (pedestrians and motor-vehicle occupants involved in a crash) per 1M population;	City of Toronto	2016–2019	Toronto Police Service Public Safety Data Portal. Population estimates from City of Toronto Portal; Covariate data: Federal	Pseudo-intervention group: January 2018 - December 2019	Pseudo-control group: January 2016 - December 2017	Hybrid DiD and Hybrid-fuzzy DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	3) Daily number of all road users killed or severely injured (KSI) per 1M population			Government of Canada portal.			
Nazif-Munoz, J.I. et al. (2024)	1) Monthly prevalence rates of total drug-related (excluding cannabis) diagnosed disorders per 100,000 pregnant women; 2) Monthly prevalence rates of cannabis-related diagnosed disorders per 100,000 pregnant women; 3) Monthly prevalence rates of alcohol-related diagnosed disorders per 100,000 pregnant women	Pregnant women aged 15-49 years	2010–2022	Québec Integrated Chronic Disease Surveillance System	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
Nemer, L. et al. (2021)	Hospitalizations for hyperemesis	Patients aged 18+ with a diagnosis of hyperemesis	2011, 2015	State Inpatient databases (SID).	CO, WA	AZ, FL	Natural experiment: regression analyses
Nguyen, H.V. & Mital, S. (2022)	Past 3-month cannabis use	Youth aged 15-20	2018–2020	National Cannabis Survey	Quebec	All other provinces	DiD
Nguyen, H.V. et al. (2023)	1) Past 12-month use; 2) Cannabis initiation rates; 3) Age of first cannabis use; 4) Perceived ease of access to cannabis; 5) Perceived harm from occasional (smoking) cannabis use; Perceived harm from regular (smoking) cannabis use	Canadian youth aged 15-18 (n=49,060) and Canadian students in grades 9-12 (n=219,917)	1) CTUMS = 2004–2019; 2) YSS = 2006–2019 3) Age of first use = 2004–2019; 4) Ease of access = 2012–2019; 5) Perceived harm = 2014–2019	Canadian Tobacco Use Monitoring Surveys (CTUMS): 1999 - 2012; Canadian Tobacco Alcohol & Drugs Surveys (CTADS): 2013-2017, 2019; Canadian Tobacco & Nicotine Survey (CTNS): 2013-2017, 2019; Youth Smoking Survey (YSS): 2006 - (biennial); Canadian Student Tobacco	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Nguyen, H.V. et al. (2023)	Number of medical shipments per 100,000 population	Medical cannabis shipments in Canada (mail-order deliveries of cannabis from a licensed producer to a patient authorized to obtain medical cannabis)	2014–2020	Alcohol & Drugs Surveys (CSTADS) Data on medical shipments at the national level and by province: Health Canada	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
Nguyen, H.V. et al. (2024)	1) Opioid prescription rates per 100 persons; 2) Opioid overdose deaths per 100,000 population	Opioid prescriptions and mortality between 2006 and 2020 in the US	2006–2020	US Centers for Disease Control and Prevention; IQVIA Xponent database; National Vital Statistics Multiple Cause of Death Files; CDC Wide-Ranging Online Data for Epidemiological Research (CDC-WONDER)	U.S. states that had adult-use retail stores	U.S. states that had not implemented adult-use cannabis and had same confounding opioid laws as treated states	DiD accounting for staggered adoption
Noureldin, M. et al. (2024)	Mean opioid prescribing rate per 1,000 IBD patients	Commercially insured individuals at 18-65 in the U.S. with at least 3 distinct encounters associated with a diagnosis of IBD based on ICD-9-CM	2009–2016	IBM MarketScan	CO, WA	17 U.S. states without medical or adult use cannabis laws (ID, WY, SD, NE, KS, TX, IA, WI, IN, KY, TN, MS, AL, GA, SC, NC, VA)	DiD
Okey, S.A. et al. (2022)	Prevalence of medical cannabis cardholders	States with medical cannabis laws and state-run medical registries (not volunteer run)	2013–2020	medical cannabis registries; American Community Survey	U.S. states that had legalized adult-use cannabis U.S. states that had legalized	U.S. states with medical cannabis laws but not adult-use cannabis laws	Natural experiment: regression analyses

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Orsini, M.M. et al. (2023)	Past-month cannabis use	Longitudinal sample of young people aged 12-23	2013–2019	Population Assessment of Tobacco and Health (PATH)	adult-use cannabis and had adult-use stores. U.S. states that had legalized adult-use cannabis	U.S. states where adult-use cannabis is decriminalized. U.S. states where adult-use cannabis is criminalized	Natural experiment: regression analyses
Orsini, M.M. et al. (2024)	Past year blunt use	Longitudinal sample of young people aged 12-23	2013–2019	Population Assessment of Tobacco and Health (PATH); Americans for Nonsmokers Rights Foundation, National; Organization for the Reform of Marijuana Laws, Nexis Uni, HeinOnline; Municode, and American Legal Publishing Corporation	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized medical or adult-use cannabis	Natural experiment
Ortego, A. (2023)	Number of mental health treatment admissions per 10,000	Individuals aged 13 and over admitted to mental health treatment facilities	2007–2019	SAMHSA's Uniform Reporting System (URS)	10 U.S. states that had legalized adult-use cannabis by 2019 (AK, CA, CO, ME, MA, MI, NV, OR, VT, WA)	All other states	DiD accounting for staggered adoption
O'Hara, S.E. et al. (2023)	1) Past month cannabis use; 2) Past month alcohol use; 3) Past month alcohol and cannabis co-use	9th and 11th grade students in 38 California cities	2010–2019; (2010/11–2018/19)	California Healthy Kids Surveys; Covariates: U.S. Census Data, California Bureau of	Greater adult-use cannabis store density in CA	Lower adult-use cannabis store density in CA	Natural experiment: regression analyses

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
				Cannabis Control, California Department of Alcoholic Beverage Control			
Pearson, J.L. et al. (2024)	1) Lifetime cannabis use; 2) Past 30 day cannabis use	Middle school students in Nevada and New Mexico	2017, 2019	NV Youth Risk Behavior Survey; NM Youth Risk and Resiliency Survey	Nevada	New Mexico	DiD
Penney, S.R. et al (2024)	Positive urine drug screens for cannabis or any synthetic cannabinoid	Forensic patients in Ontario with an admission date between January 2010 and October 2016 and who were not discharged prior to October 2020	2016–2020	Two large forensic mental health programs in Ontario.	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
Perrault-Sequeria, L. et al. (2025)	1) PTSD ED visits per capita; 2) PTSD + cannabis ED visits per capita; 3) PTSD + alcohol ED visits per capita; 4) PTSD + cannabis ED visits per 1000 PTSD ED visits; 5) PTSD + alcohol ED visits per 1000 PTSD ED visits	ED visits among Ontario residents between 10-105 who were eligible for Ontario's public health coverage.	2008–2022	Institute for Clinical Evaluative Sciences (ICES) databases; National Ambulatory Care Reporting System; Registered Persons Database.	Post-legalization (Phase 1) Post retail expansion in Ontario (aligning with Phase 2)	Pre-legalization (Phase 1) Pre retail expansion in Ontario, but post-legalization (aligning with Phase 2)	ITSA
Peters, T. & Foust, C. (2019)	1) Frequency of use: Number of times they had used cannabis in the past 30 days; 2) Perceived ease of access; 3) Perceived harmfulness of regular cannabis use; 4) Perceived wrongfulness of the use of cannabis at your age?	High school students within 7 communities in southcentral Colorado	2013, 2015	Health Kids Colorado Survey	Three communities in CO that permitted adult-use retail sales	Four communities in CO that did not permit adult-use retail sales	Natural experiment: regression analyses
Plakias, Z. et al. (2021)	Banking indicators: 1) Total assets; 2) Total liabilities; 3) Total shares and deposits; 4) Amount of	California banking sector	2015–2020	Quarterly call reports: Federal Financial Institutions Examination Council	Counties in CA with any state cannabis	Dry' counties in CA with no state cannabis	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	loans; 5) Amount of agriculture loans; 6) Interest income; 7) Fee income; 8) Number of full-time employees			Central Data Repository; Credit union data: National Credit Union Administration; Retail data: Manufactured Cannabis Safety Branch of the California Department of Public Health; California Bureau of Cannabis Control's California Cannabis Portal	cultivation licenses	cultivation licenses	
Plunk, A.D. et al. (2019)	State cannabis possession arrest rate per 100,000 population	Youth and adults with arrests for cannabis possession	2000–2016	Uniform Crime Reporting Program data by age, sex, and race; Population data: National Cancer Institute's county-level US population data; Denver police department; Sources for covariates stated in supplemental files.	4 U.S. states that had legalized adult-use cannabis	27 states where the penalty for adult-use cannabis did not change in the study period (illegal)	DiD
Pravosud, V. et al. (2024)	1) Past 30-day cannabis use; 2) Current ("now") tobacco/nicotine use (smoking or e-cigarettes); 3) Current co-use of cannabis and tobacco/nicotine	U.S. adults aged 18+	2017–2021	KnowledgePanel	U.S. states that had legalized adult-use cannabis	U.S. states without medical or adult-use cannabis laws	Natural experiment: regression analyses
Prestemon, J.P. et al. (2019)	Number of reports of illegal grow operations on national forests	111 national forests	2004–2016	Please see Table 2 in article.	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use cannabis	Natural experiment: regression analyses
Raman, S. & Bradford, A.C. (2022)	Logged prescription rate per 100,000 Medicaid	Medicaid population	2011–2019	Medicaid State Drug Utilization Data (SDUD); RAND-	U.S. states that had legalized	U.S. states that had not legalized	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	enrollees for a condition-specific drug class			OPTIC center policy dataset; Area Health Resource Files	adult-use cannabis	adult-use cannabis	
Raman, S. et al. (2023)	Rate of prescription opioid distribution in grams per 100,000 adults over the age of 21 - all opioids and separately.	Adults aged 21+ who have been prescribed and distributed opioids (excluding methadone and buprenorphine)	2010–2019	Drug Enforcement Administrations' Automation of Reports and Consolidation Orders System (ARCOS); RAND-University of Southern California's Schaeffer Opioid Policy Tools and Information Center database, Area Health Resource File	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use cannabis	DiD
Reed, S.E. et al. (2024)	Latent class analysis of: 1) Abstainers (no alcohol or cannabis use); 2) Light alcohol only (few alcohol use days in last 30 days, <1 binge drinking time in past 2 weeks and no cannabis use in past 30 days; 3) Heavy alcohol only (frequent alcohol use, and no cannabis use); 4) Moderate co-use; 5) Heavy co-use ; 6) Predominantly heavy cannabis use	Four-year college students aged 18-24	2008–2018	National College Health Assessment-II Survey	7 U.S. states that had legalized adult-use cannabis	42 U.S. states that did not have adult-use cannabis laws	Natural experiment: regression analyses
Reid, J.L. et al. (2023)	Perceived ease of access (very/fairly easy vs. other)	Youth aged 16-19	2017–2021	International Tobacco Control Youth Tobacco and Vaping Survey	Canada	U.S. England	Natural experiment: regression analyses
Rivera-Aguirre, A. et al. (2022)	1) Past year cannabis use; 2) Past month cannabis use; 3) Risky cannabis use (using Cannabis Abuse Screening Test); 4)	Secondary school students in 8th, 10th, and 12th grade in urban	2007–2018	Uruguayan National Drug Observatory; Chilean Drug Observatory	Uruguay	Chile	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	Frequent cannabis use (10 or more days in the past month)	areas of Uruguay and Chile					
Roth, W. et al. (2022)	Total monthly cannabis or cannabis-containing product exposure ("actual or suspected contact with any substance which has been ingested, inhaled, absorbed, applied to, or injected into the body, regardless of toxicity or clinical manifestation")	Human exposures to cannabis and cannabis-containing products reported in CA.	2010–2020	California Poison Control System	Post-legalization in CA Post adult-use retail stores in CA	Pre-legalization in CA Pre-adult-use retail stores in CA	ITSA
Sabia, J.J. et al. (2024)	1) Drug use: a) past 30-day cannabis use; b) past 30-day illicit drug use other than cannabis; c) past year cocaine use; d) past year non-medical use pain relievers; e) past 30-day binge drinking 2) Drug treatment admissions per 1,000 population for a) cannabis b) cocaine c) methamphetamine d) heroin e) other opioids 3) Drug-related arrests rate per 1,000 population involving adult arrestees for possession of a) all drugs b) marijuana c) powder cocaine, crack cocaine, heroin and other opium d) truly addicting synthetic narcotics e) other dangerous non-narcotic drugs	Non-institutionalized individuals aged 18+	2000–2019	NSDUH; Uniform Crime Reports; Surveillance, Epidemiology, and End Results; National Vital Statistics System; Treatment Episode Data Set (TEDS)	U.S states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use cannabis	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	4) Drug-related arrests rate per 1,000 population involving adult arrestees for sale of a) all drugs b) marijuana c) powder cocaine, crack cocaine, heroin and other opium d) truly addicting synthetic narcotics e) other dangerous non-narcotic drugs						
	5) Property crime arrests; 6) Violent crime arrests						
Santaella-Tenorio, J. et al. (2020)	Rate of traffic fatalities per 1 billion VMT (individuals fatally injured in motor vehicle crashes on public roads and died within 30 days)	Traffic fatalities in the CO, WA.	2005–2017	Fatality Analysis Reporting System from National Highway Traffic Safety Administration.	CO, WA (separate)	Donor pool of 42 U.S. states that had not legalized adult-use cannabis	SCM
Segura, L.E. et al. (2025)	1) Past year cannabis use; 2) Past month cannabis use; 3) Past month daily cannabis use; 4) Past year CUD	Non-institutionalized individuals aged 12+	2008–2017	NSDUH	9 U.S. states that had legalized adult-use cannabis	U.S. states pre-legalization and all other states without medical or adult use laws	Natural experiment (but authors state their approach approximates DiD)
Sennott, C. et al. (2022)	1) Average birth weight; 2) Average gestational age; 3) Percentage of births classified as low birthweight; 4) Percentage of births classified as preterm	Women who delivered live-born infants in the U.S.	2003–2019	CDC WONDER; American Community Survey; Multiple legal websites for cannabis laws (e.g., National Organization for the Reform of Cannabis Laws); Covariates: Center for American Women in Politics, Rutgers Eagleton Institute and National	U.S. states that legalized adult-use cannabis in the study period	U.S. states where cannabis possession was a misdemeanor	Natural experiment

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Shanaev, S. et al. (2024)	Bitcoin daily log-returns	Bitcoin logs	2010–2022	Conference of State Legislatures Coinmarketcap; Bureau of Economic Analysis; census.gov	Post-legalization in U.S. states that had legalized adult-use cannabis	Pre-legalization in U.S. states that had legalized adult-use cannabis	Event study analyses
Sheehan, B.E. et al. (2021)	Cannabis possession arrest rates per 100,000 by race	White and Black residents arrested for cannabis possession	2000–2019	Arrest data: Uniform Crime Reporting Program; Denver Police Department; population data by race: Surveillance, Epidemiology, and End Results	9 U.S. states that legalized adult use cannabis in the study period	26 U.S. states that did not change cannabis policy in the study period	Event-study analyses
Shi, Y. et al. (2019)	Per quarter, per 100 Medicaid employees: 1) Log Number of opioid prescriptions; 2) Log Total doses of opioid prescriptions (in quantity of morphine milligram equivalents); 3) Log Medicaid spending on opioid prescriptions	Filled prescription drugs dispensed in outpatient settings for Medicaid enrollees	2010–2017	Prescription data: Medicaid State Drug Utilization Records; Medicaid Managed Care Enrollment Reports	CO, WA; CO, WA, DC, OR, AK; *Compares legal states among themselves depending on timing of adult-use legalization U.S. states that had legalized adult-use cannabis	AK, DC, OR, CA, MA, ME, NV; CA, MA, ME, NV; *Compares legal states among themselves depending on timing of adult-use legalization U.S. states with medical cannabis laws but not adult-use cannabis laws	DiD
Shi, Y. & Liang, D. (2020)	State age-adjusted rates of human exposures involving cannabis per 1,000,000 population per quarter.	Exposures to cannabis reported to the NPDS	2010–2017	U.S. National Poison Data System (NPDS)	9 U.S. states that legalized adult use cannabis 5 U.S. states that legalized adult-use retail stores	Control group A: 6 U.S. states that had legalized medical cannabis as of Jan 2010 (HI, MI, MT, NM, RI, VT); Control group B: 22 U.S. states that had	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Skelton, K.R. et al. (2021)	1) Self-reported cannabis use during the 12 months before pregnancy (preconception); 2) Self-reported cannabis use during pregnancy (prenatal); 3) Self-reported cannabis use 2-6 months after pregnancy (postpartum)	Women who delivered live-born infants in the U.S.	2004–2018	Pregnancy Risk Assessment Monitoring System (PRAMS);	AK, ME	not legalized medical or adult-use cannabis by Dec 2017; Control group C: 42 U.S. states that had not legalized adult-use cannabis	DiD
Soh, J. et al. (2024)	Emergency department visits for cannabis hyperemesis syndrome	ED visits in Nevada for cannabis hyperemesis syndrome from all non-federal acute community hospitals	2013–2021	State Emergency Department Databases of Nevada	Post retail sales in NV	Pre retail sales in NV	ITSA
Stanton, D. et al. (2020)	Monthly number of jail bookings per 100,000 people	Residents within jails of WA	2009–2016	Washington State Office of Financial Management	Post-legalization in WA After adult-use retail stores in WA	Pre-legalization in WA Before adult-use retail stores in WA	ITSA
Steuart, S.R. et al. (2025)	1) Rate of patients with prescriptions filled per 10,000 enrollees in each state-quarter for a) Opioids; b) NSAIDs; c) other non-opioid pain medications ; 2) Average number of days supplied per prescription for a) Opioids; b) NSAIDs;	Individuals aged 18-64 (excluded claims for Medicare Advantage patients, did not have at least 6 months of continuous enrollment, had a cancer diagnosis)	2007–2020	Optum's de-identified Clinformatics Data Mart Database; Centers for Disease Control and Prevention's National Center for Injury Prevention and Control; American	U.S. states that had legalized adult-use cannabis between 2011 and 2017 (AK, CA, CO, DC, MA, OR, WA)	Pool of donor units from states without adult-use cannabis laws	SCM with staggered treatment adoption

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	c) other non-opioid pain medications ; 3) Average number of prescriptions per patient in each state-quarter for a) Opioids; b) NSAIDs; c) other non-opioid pain medications			Hospital Formulary Service Pharmacologic-Therapeutic Classification System	U.S. states that opened adult-use retail stores between 2011 and 2017 (AK, CO, OR, WA)		
Thacker, J. et al. (2021)	1) Total number of arrests; 2) Arrests for property crimes; 3) Arrests for violent crimes; 4) Arrests for Drug offenses; 5) Arrests for other offenses	Neighborhoods in Seattle, Bellevue and Tacoma	2012–2018	Retail outlet data: Traceability (WA's seed-to-sale database); Monthly sales data: Washington State Liquor and Cannabis Board (WSLCB); Demographic data: American Community Survey; Business license data: WA State Department of Revenue; Crime data: arrest data from local cities police department	Neighborhoods in WA that have opened an adult-use retail store	Neighborhoods in WA that have not opened an adult-use retail store; A synthetic comparison of the treated neighborhoods that have similar trends pre-store	DiD and SCM
Veligati, S. et al. (2020)	1) Per capita consumption of alcohol (as measured by state tax receipts); 2) Per capita consumption of cigarettes (as measured by state tax receipts)	Alcohol and cigarette state tax receipts	1990–2016	Alcohol sales surveillance report of the National Institute on Alcohol Abuse and Alcoholism; alcohol beverage sales from Alcohol Epidemiologic Data System; Covariates: multiple data sources (see Table 1 in article)	U.S. states that had legalized adult-use cannabis	U.S. states without medical cannabis retail stores and/or prohibited cannabis use U.S. states with 'non-medicalized' medical cannabis programs and/or prohibited cannabis use U.S. states without medical	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Voy, A. (2023)	Count of collisions: 1) Fatal injury; 2) Serious injury; 3) Minor injury; 4) Non-injury; 5) All injuries	Traffic collisions recorded in WA	2011–2017	Dispensary data: Washington State Liquor and Cannabis Board; Crash data: Washington State Department of Transportation	Post-legalization in WA More adult-use cannabis retail sales in WA	cannabis laws/prohibited use Pre-legalization in WA Fewer adult-use cannabis retail sales in WA	ITSA
Vuolo, M. et al. (2022)	1) Any past month cigarette use; 2) Frequency of cigarette use (# of days in past 30 days); 3) Near daily cigarette use (25+ days in the past 30 days)	Longitudinal cohort of adolescents initially aged 12-16 in 1997 and followed through 2015	1997–2011, 2015	National Longitudinal Survey of Youth 1997; Tobacco laws: Americans for Nonsmokers' Rights Foundation. Cannabis laws: National Organization for the Reform of Cannabis Laws, Nexis Uni, HeinOnline, Municode, American Legal Publishing Corporation	U.S. states that had legalized adult-use cannabis	U.S. states where cannabis possession was a felony	Natural experiment: regression analyses
Walker, M. et al. (2023)	Monthly rates per 100,000 people: 1) ED visits for motor vehicle accidents; 2) ED visits for pedestrian/cyclist incidents	Patients attending hospital for motor vehicle or pedestrian injuries	2010–2021	ED visits data: Canadian Institute for Health Information's National Ambulatory Care Reporting System; Hospitalization data: CIHI's Discharge Abstract Database	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
Wallace, C.T. et al. (2025)	1) Natural log of parental drug abuse counts; 2) Natural log of teenage drug abuse counts	Number of entrants into foster care related to parental or teenage drug abuse	2007–2019	Adoption and Foster Care Analysis and Reporting System (AFCARS); Insurance Institute for Highway	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized medical or adult-use cannabis	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
				Safety (IIHS); Bureau of Economic Analysis; State Health Access Data Assistance Center (SHADAC)			
Walsh, P.S. et al. (2024)	Advanced neuroimaging: 1) CT or MRI of the brain; and 2) lumbar puncture; 3) ICU admission; and 4) Mechanical ventilation; 5) Any laboratory testing; 6) Any imaging; 7) Serum blood testing; 8) Urine testing; 9) Any toxicology testing	Emergency department encounters in tertiary nonprofit pediatric hospitals affiliated with the Children's Hospital Association for children <6 with a diagnosis indicating cannabis ingestion	2016–2023	Pediatric Health Information System	U.S. states that had legalized adult-use cannabis	All other states that had not legalized adult-use cannabis	Natural experiment: regression analyses
Wang, P. et al. (2019)	1) Searches for cannabis; 2) searches for alcohol; 3) Alcohol ad clicks; 4) Published revenue from alcohol ads; 5) Searches for tobacco; 6) Tobacco ad clicks; Publisher revenue from tobacco ad	Web-based indicators for cannabis, alcohol, and tobacco	2014–2017	Large-scale web-based data on online searches, impressions and clicks from a U.S. based web portal	AK, CA, DC, ME, MA, NV, OR	10 U.S. states without any form of cannabis policy change	DiD
Wang, G.S. et al. (2021)	Vomiting-related ED visits	Vomiting-related ED visits in counties in CO with and without medical retail stores pre-legalization	2013–2018	Cannabis stores: Colorado Department of Revenue Marijuana Enforcement Division; ED claims: Colorado Hospital Association	CO counties with low numbers of medical retail stores at baseline (before legalization) CO counties with high numbers of medical retail stores at baseline (before legalization)	CO counties with no medical retail stores at baseline (before legalization)	Natural experiment: regression analyses

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Wang, G.S. et al. (2022)	1) Rates of ED visits for psychosis per 10,000 residents; 2) Rates of ED visits for schizophrenia per 10,000 residents	Patients attending ED in Colorado for psychosis and schizophrenia	2013–2018	ED visits data: Colorado Hospital Association; Store data: Colorado Department of Revenue; Covariates: American Health Resource File, Bureau of Labor Statistics	CO counties with more adult-use retail stores	CO counties with fewer adult-use retail stores	DiD
Wang, G.S. et al. (2022)	Cannabis-involved pregnancy hospitalizations per 10k live births per county	Cannabis-related pregnancy hospitalizations reported to the CHA.	2011–2018	Colorado Department of Revenue; Colorado Hospital Association; Population data: Colorado Department of Public Health and Environment	High number of adult-use cannabis stores in CO High number of baseline medical cannabis stores in CO Low number of baseline medical cannabis stores in CO	Lower number of adult-use cannabis stores in CO No medical cannabis stores at baseline in CO No medical cannabis stores at baseline in CO	Natural experiment: regression analyses
Weinberger, A.H. et al. (2021)	1) Past month co-use of cannabis and cigarettes; 2) Past month cigarette use only (no cannabis); 3) Past month cannabis use only (no cigarettes)	Non-institutionalized individuals aged 12+	2004–2017	NSDUH	U.S. states that legalized adult-use cannabis	U.S. states that had not legalized medical or adult-use cannabis in the study period	DiD
Weinberger, A.H. et al. (2022)	1) Past month cannabis use; 2) Daily cannabis use	Non-institutionalized individuals aged 12+	2004–2017	NSDUH	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use cannabis and/or medical cannabis	Natural experiment: regression analyses
Wen, J. et al. (2021)	1) Monthly morphine milligram equivalent (MME) per enrollee; 2) MME per pain patient prescribed	Active employees and their dependents, early retirees, and	2009–2015	Truven Health MarketScan Commercial Claims	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized medical or adult-use cannabis	DiD

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	opioids; 3) MME per non-pain patient prescribed opioids; 4) Number of pain patients prescribed opioids per 1,000 enrollees; 5) Number of non-pain patients prescribed opioids per 1,000 enrollees	Consolidated Omnibus Budget Reconciliation Act employees aged 18-64.		and Encounters Database			
Wilds, K.M. & Riddell, J.R. (2023)	1) Past month cannabis use; 2) Past month alcohol use; 3) Difference between alcohol and cannabis past month rate	Non-institutionalized individuals aged 12+; Assumed due to use of NSDUH but authors do not clearly state age range	2002–2019	NSDUH; State data: NORML; Covariate data: U.S. Census Bureau, the Bureau of Labor Statistics	7 U.S. states and DC that had legalized adult-use cannabis (AK, CA, CO, MA, NV, OR, WA)	26 U.S. states with either a decriminalization law or medical cannabis law	DiD
Willits, D. W. et al. (2022)	Sum of cannabis possession arrests per month by race	Residents arrested for cannabis possession in CO, WA	2009–2016	Crime data: Uniform Crime Report	Post-legalization in CO and WA	Pre-legalization in CO and WA	ITSA
Windle, S.B. et al. (2021)	1) Rates of fatal motor vehicle collisions per 100,000 person-years; 2) Rate of deaths due to motor vehicle collisions per 100,000 person-years	Fatal motor vehicle collisions in 11 U.S. states that had legalized adult-use cannabis before 2019	2007–2018	US Fatality Analysis Reporting System	Post-legalization in U.S. states that had legalized adult-use cannabis before 2019 After adult-use retail stores in U.S. states that had legalized adult-use cannabis before 2019	Pre-legalization in U.S. states that had legalized adult-use cannabis before 2019 Before adult-use retail stores in U.S. states that had legalized adult-use cannabis before 2019	ITSA
Worrall, J.L. et al. (2022)	Amount of cannabis (in pounds) seized by USPIS by state	Cannabis seizures across the U.S.	2010–2019	United States Postal Inspection Service (USPIS) marijuana seizure data; State law: National Conference of State	U.S. states that had legalized adult-use cannabis	U.S. states that had not legalized adult-use or medical cannabis	Natural experiment: regression analyses

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
				Legislatures; Demographics: US Census, Uniform Crime Reports			
Wu, G. et al. (2020)	Yearly crime rate per 100,000 people: 1) Violent crime ; 2) Property crime; 3) Robbery; 4) Aggravated assault; 5) Burglary; 6) Larceny; 7) Auto theft; 8) Simple assault	Residents arrested for offenses	2003–2017	Crime data: Uniform Crime Report; Covariate data: U.S. Census Bureau's Small Area Income and Poverty estimates; Bureau of Labor Statistic's Local Area Unemployment Statistics	Border counties of WA Border counties of CO	Non-border counties of WA Non-border counties of CO	DiD
Wu, G. et al. (2021)	Annual rate per 100,000 people for: 1) Violent crime; 2) Property crime; 3) Robbery; 4) Aggravated assault; 5) Burglary; 6) Larceny; 7) Auto theft	Residents conducting crime	2007–2017	Crime data: Uniform Crime Report data; Covariate data: U.S. Census Bureau's Small Area Income and Poverty estimates; Bureau of Labor Statistic's Local Area Unemployment Statistics	OR	19 U.S. states that had not legalized adult-use or medical cannabis	DiD; SCM
Wu, G. et al. (2022)	Yearly clearance rates (number of offenses cleared by arrest/total number of offenses):1) Violent crime overall; 2) Aggravated assault; 3) Rape; 4) Robbery Yearly arrest rates:1) Violent crime overall; 2) Aggravated assault; 3) Rape; 4) Robbery	Residents conducting crime; police departments clearing crime	2007–2017	Crime data: Uniform Crime Report data; Covariate data: U.S. Census Bureau's Small Area Income and Poverty estimates; Bureau of Labor Statistic's Local Area Unemployment Statistics	OR	19 U.S. states that had not legalized adult-use or medical cannabis	DiD
Wu, G. & Cullenbine, R.R. (2022)	Monthly offense rates per 100,000; 1) Cannabis possession; 2) Cocaine,	Residents arrested for drug-related offenses	2007–2019	Crime data: Uniform Crime Report data	WA	40 U.S. states that had not	C-ITSA

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
	heroin and their derivatives possession; 3) Other dangerous nonnarcotic drugs possession					legalized adult-use cannabis	
Wu & Willits (2022)	Annual simple assault rate per 100,000	Residents conducting simple assault	2007–2017	Assault data: Uniform Crime Reporting data; Covariate data: U.S. Census Bureau's Small Area Income and Poverty estimates; Bureau of Labor Statistics' Local Area Unemployment Statistics	OR	19 U.S. states that had not legalized adult-use or medical cannabis	Natural experiment; Coarsened exact matching; SCM
Wu, G. et al. (2023)	1) Black-to-White disparity in prison incarceration rates; 2) Black-to-White disparity in drug-related prison incarceration rates	Black and White identifying individuals in prison populations	2006–2018 (CO); 2006–2016 (WA)	Bureau of Justice Statistics (BJS) National Corrections Reporting Program (NCRP) ; U.S. Census Bureau, Bureau of Labor Statistics Local Area Unemployment Statistics. ; FBI's Uniform Crime Reporting (UCR) Program data,	WA, CO	A synthetic pool of 30 U.S. states that had not legalized adult-use cannabis 30 U.S. states that had not legalized adult-use cannabis	DiD and SCM
Wu, G. et al. (2023)	1) Past month cannabis use; 2) Initiation of cannabis	Adolescents aged 12-17 in WA	2005–2019	National Survey on Drug Use and Health; U.S. Census Bureau's Small Area Income and Poverty Estimates; Bureau of Labor Statistics' Local Area Unemployment Statistics	WA	40 U.S. states that had not legalized adult-use cannabis	DiD and SCM

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Wu, G. et al. (2024)	Black-to-White ratio of jail incarceration rates	County jail data (accounts for 1/3 of all jails in the U.S.)	2007–2019	Bureau of Justice Statistics; Census of Jails; Annual Survey of Jails; U.S. Census Bureau's Small Area Income and Poverty Estimates; Bureau of Labor Statistics Local Area Unemployment Statistics	CO, WA (together) CO, WA (separate)	34 U.S. states that had not legalized adult-use cannabis Synthetic CO Synthetic WA	DiD and SCM
Yang, K.H. et al (2024)	Rate of microdosing Google searches	Google searches on microdosing	2010–2023	Google search queries of "microdosing", "micro dosing", "microdose" and "micro dose"	U.S. states that had legalized adult use cannabis	All other states	DiD
Yeung, M.E.M. et al. (2020)	1) Cannabis-related ED visits; 2) Calls to HealthLink, a public provincial tele-health service; 3) Calls to PADIS, a provincial poison control service	Patients that visited EDs in Alberta or called telehealth or poison centers with a cannabis-related ICD code (e.g., hyperemesis, cannabis poisoning)	2013–2019	National Ambulatory Care Reporting System and the Alberta Poison and Drug Information Service and HealthLink provincial databases	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
Yeung, M.E.M. et al. (2021)	Cannabis-related pediatric visits to the ED	Patients that visited EDs in Alberta aged 0 - 17 years (inclusive) with a cannabis-related ICD-10 code in primary or secondary diagnostic fields	2013–2020	National Ambulatory Care Reporting System and the Alberta Poison and Drug Information Service and HealthLink provincial databases	Post-legalization (Phase 1)	Pre-legalization (Phase 1)	ITSA
Young-Wolff, K.C. et al. (2024)	Any prenatal cannabis use, defined as 1) positive urine toxicology test result or self-report; 2) positive urine toxicology test result; 3) self-report.	Pregnancies universally screened for prenatal cannabis use at entrance to prenatal care in Northern California	2012–2019	Kaiser Permanente Northern California; CannaRegs commercial regulatory database	Post-legalization in CA Post adult-use retail stores in CA	Pre-legalization in CA Pre-adult-use retail stores in CA	ITSA

Author (Year)	Specific Outcomes	Sample Description	Study Period	Data Source	Treated Condition	Control Condition	Design
Zambiasi, D. & Stillman, S. (2019)	1) Total inflow of people (per 100,000) into CO; 2) Total outflow of people (per 100,000) from CO	Residents migrating to/from CO	2005–2015	American Community Survey; covariates: Annual Survey of State Government Tax Collections; Department of Housing and Urban Development Fair Market Rent series	CO	Synthetic CO (Donor pool of 20 U.S. states that had not legalized adult-use cannabis by 2017)	SCM

NOTE: Table features outcome categories, specific measures, population restrictions, data sources, and study design for each study.

Abbreviations

ACL	adult-use cannabis law
BVMT	billion vehicle miles traveled
CI	confidence interval
CUD	cannabis use disorder
DID	difference-in-differences
MCL	medical cannabis law
NSDUH	National Survey on Drug Use and Health
THC	tetrahydrocannabinol
WC	workers' compensation

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