

Cannabis use disorder, the gateway question and legalization

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This report marks the fifth installment in our “real facts” report series — a first-of-its-kind effort to better understand and summarize the effects of cannabis legalization in other states.

As we’ve previously noted, legalization of adult recreational marijuana does increase usage — that is, the number of people using it. In this report, we will examine whether — given that fact — legalization also increases so-called cannabis use disorder and, separately, whether cannabis is a “gateway” drug that leads to the use of other substances.

Studies of legalization take place against a backdrop of a large and concerning rise in substance use disorders. Data from the National Survey on Drug Use and Health shows that the number of Americans struggling with a “cannabis use disorder” — the technical term used by researchers for uncontrolled and harmful use — specifically has gone up more than 33% since 2020, climbing from 14.2 million to nearly 19 million Americans.¹

The research we found can be summarized as follows:

- The weight of the evidence indicates that legalization of cannabis for adult use is likely to increase the uncontrolled and harmful use of cannabis in Wisconsin, but it is unclear what impact allowing medical use might have, given an equal division in the research on that topic.
- The legalization of cannabis for adult use will reduce opioid use and overdoses, while the research on allowing medical use shows only that it will reduce use, not overdoses.

- There appears to be a strong possibility that the legalization of cannabis for medical or adult use will reduce the use of other illicit substances, but the current body of literature is divided on this point.
- Evidence from states early to legalize shows that cannabis is a substitute product for alcohol and tobacco and that the legalization of cannabis for adult use has reduced alcohol and tobacco consumption. The impact of medical legalization on alcohol and tobacco consumption is still understudied and unclear.

Cannabis Use Disorder

The use of cannabis by either youth or adults becomes especially concerning when it develops into dependence, addiction or a cannabis use disorder. It is important to isolate this potential outcome from use alone, given the greater harm a use disorder can have on individuals, their families and their communities. We will take a closer look at the issue of addiction in an upcoming paper on health impacts.

Adult Use: There is a conflict in the body of research on this topic. Half of the studies we located find that legalization increases cannabis use disorder in states that legalize adult use.² However, this limited number of studies directly conflicts with the findings of four other equally credible studies — two finding that it decreased use disorders and two finding that it had no impact on treatment admission for use disorder.

Researchers have taken very different approaches to this question in hopes of definitively answering this important question, and two studies showcase these different methodol-

ogies. Deborah Hasin and her colleagues utilized data from the Veterans Health Administration on doctor-identified substance use disorder to analyze the impact of adult use legalization.³ This research team found that cannabis use disorder increased in all states regardless of the legal status of cannabis but that only 9.8% of the larger increase in states with adult access could be attributed to that policy change.⁴ The authors were not able to specifically identify the factors that increase cannabis use disorder in states without any legal form of access but hypothesize that reasons could include the general trend toward increased use of a variety of substances.

A paper finding the opposite was published by Ellen Kurtzman and Burt Barnow in 2023 and utilized emergency department data from four states.⁵ In this sample of data, also

reported by doctors, they found that the frequency of cannabis use disorder was 50% lower in states with adult use legalization.⁶ The authors and other researchers on the topic speculate that it is difficult to determine whether this is an actual decline or merely a decline in reporting because of increased social acceptability, so additional research is needed with more diverse methodologies to reach a more definitive conclusion.⁷

Medical: The impact of this policy is unclear because most of the studies exploring it are significantly older than the body of research exploring adult use legalization and there is a near-equal split with three studies showing an increase and two finding it has no impact.⁸ Deborah Hasin and a separate group of colleagues explored this question in a

What is a cannabis use disorder?

Dependence, addiction, and use disorder are three distinct but interconnected terms that describe a harmful relationship with any substance. We are utilizing the broadest category — “cannabis use disorder” — because it is relied upon by scientific community.

These three terms can be defined as follows:

Use disorder: An “uncontrolled use of a substance despite harmful consequence” where a “person's ability to function in day-to-day life becomes impaired.” The Substance Abuse and Mental Health Services Administration considers individuals to have a use disorder when they fulfill two of the 11 criteria outlined by the American Psychiatric Association (APA).*

Addiction: The most severe form of a use disorder; generally considered to occur when someone fulfills six of the APA criteria.

Dependency: A use disorder symptom that involves multiple APA criteria such as increased tolerance, the need to use greater amounts of a substance to achieve the same level of intoxication, and experiencing withdrawal when a substance is not used.

*Adam A. McNeely, Substance Use Screening and Risk Assessment in Adults [Internet], Johns Hopkins University (2020), available at: <https://www.ncbi.nlm.nih.gov/books/NBK565474/table/nycgsubuse.tab9/>.

The 11 criteria for a use disorder outlined by the American Psychological Association are:

Consuming the substance in larger amounts and for a longer amount of time than intended.

Persistent desire to cut down or regulate use. The individual may have unsuccessfully attempted to stop in the past.

Spending a great deal of time obtaining, using, or recovering from the effects of substance use.

Experiencing craving, a pressing desire to use the substance.

Substance use impairs ability to fulfill major obligations at work, school, or home.

Continued use of the substance despite it causing significant social or interpersonal problems.

Reduction or discontinuation of recreational, social, or occupational activities because of substance use.

Recurrent substance use in physically unsafe environments.

Persistent substance use despite knowledge that it may cause or exacerbate physical or psychological problems.

Tolerance: Individual requires increasingly higher doses of the substance to achieve the desired effect, or the usual dose has a reduced effect; individuals may build tolerance to specific symptoms at different rates.

Withdrawal: A collection of signs and symptoms that occurs when blood and tissue levels of the substance decrease. Individuals are likely to seek the substance to relieve symptoms. No documented withdrawal symptoms from hallucinogens, PCP, or inhalants.

study published in 2017 that utilized data collected by the National Institutes of Health.⁹ They found that cannabis use disorders increased at a slightly greater rate (0.7%) in states with medical marijuana markets even though it was increasing across all states.¹⁰ A more recent study from this last year completed by two researchers at Cornell University sought to identify the long-term effects of medical marijuana policies in states.¹¹ They found that the adoption of a medical marijuana law in a state did not affect cannabis use disorder among adolescents and young adults even if the state had such a policy in place for five or more years.¹²

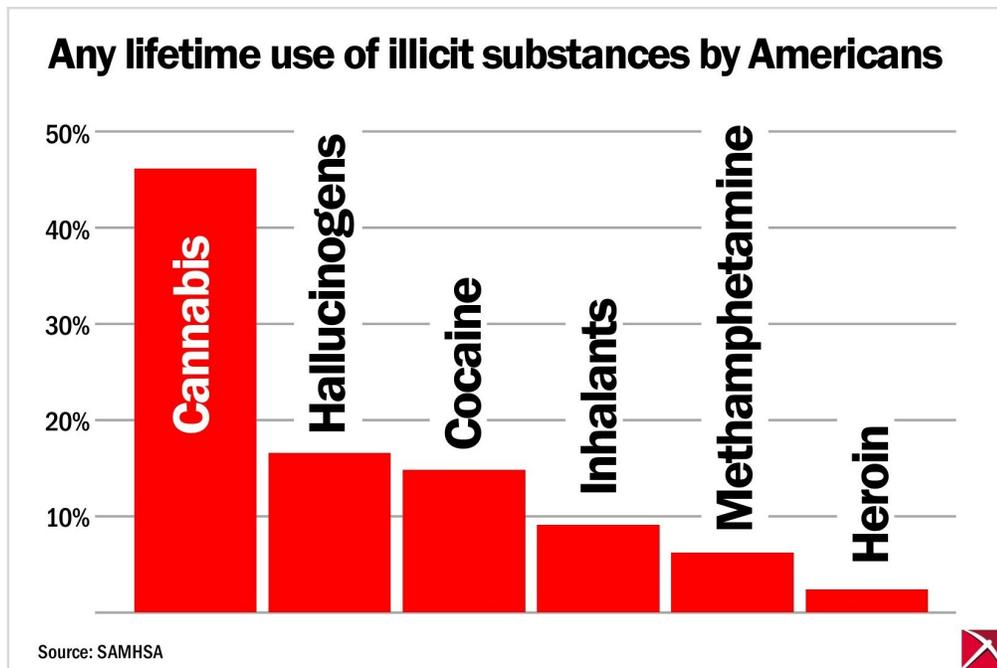
The strongest outcome that can be derived from these studies is that there might be a chance that establishing a medical cannabis market increases cannabis use disorder among the general population.

A Reduction in Disorders or Treatment?

There is also at least some initial research showing a substantial reduction in the number of people seeking treatment for cannabis use disorder.¹³ One of the potential benefits cited by advocates for ending the prohibition of cannabis is a reduction of stigma associated with it and an increased willingness of users to seek treatment.¹⁴ If the actual impact is revealed to be the opposite, then that would undermine one of the most compelling arguments for drug legalization or decriminalization. More research is needed to determine whether that hypothetical argument does not play out in practice.

Is Cannabis a “Gateway Drug?”

Forty-seven percent of Americans will use marijuana at some point in their lives, according to data from the Substance Abuse and Mental Health Services Administration. Smaller percentages will use other illicit substances, but among the other illicit substances with the highest lifetime use prevalences, none reached even half the prevalence of



marijuana. These include frequently studied substances such as cocaine (15.0%), hallucinogens, such as LSD, PCP, Ecstasy (16.6%), inhalants (9.1%), and methamphetamine (6.2%).¹⁵

There has long been a debate over whether the former, cannabis, is a “gateway” or “steppingstone” drug to the latter. In an attempt to answer this question, we searched for peer-reviewed academic research identifying what — if any — link exists between cannabis use and subsequent use of another illicit substance.¹⁶

We located 12 peer-reviewed studies that have explored the relationship between cannabis use and later use of other illicit substances, and found there is a lack of consensus about how to even complete the research that would conclusively answer this question.¹⁷

The subset of these studies that does find a gateway relationship includes papers with potentially flawed or weak methodologies which do not control for other factors at all or only control for demographic factors.¹⁸ When the research does control for other potentially causal factors like mental health, a person’s general propensity to use drugs, existing use of other substances, and life events, those researchers

overwhelmingly find that those other factors explain why someone might transition from the use of cannabis to another illicit substance.¹⁹

Studies looking at drug use patterns in other countries conclude that the use of cannabis does not lead or cause someone to use other illicit substances in the future.²⁰

The current body of research indicates that the conclusion reached by the National Academy of Sciences in the prior century that “[t]here is no conclusive evidence that the drug effects of marijuana are causally linked to the subsequent abuse of other illicit drugs,” still stands after decades more research has been completed.²¹

Real-World Evidence: Substitute vs. Complement

One of the most basic economic concepts is the idea of products being a complement or a substitute. A complementary product is one used alongside another, like popcorn and movie tickets, while a substitute displaces another product, such as electric or gas stoves. One way to explore the “gateway” concept in real life is to see if expanding access to marijuana in other states has caused their citizens to increase the use of other drugs, alcohol, and tobacco. We explore those questions separately below.

Alcohol & Tobacco Use

An ongoing debate in the fields of economics and public health has been about whether cannabis is a complement or substitute for alcohol and tobacco. Largely theoretical research was our only possible indicator for decades until states began to experiment with different legal approaches to cannabis.²² We now have a sizeable body of research analyzing the actual impact of state policy changes on the consumption of alcohol and tobacco by youth and adults, but the findings we are going to summarize below should be viewed with some caution, as there is still some disagreement among experts.

Adult use: The policy that experts have previously theorized would have the most impact on alcohol and tobacco

consumption is the legalization of cannabis for adult use in states. Examinations of real-world trends and data after legalization in early states have concluded that such a policy change will likely reduce the demand for alcohol²³ and tobacco²⁴ products. One of the most recent studies looking at the impact of legalization on demand for both substances was completed by the economists Keaton Miller and Boyoung Seo.²⁵ They utilized sales data in the state of Washington for all products from 2013 to 2016 to determine whether there was a relationship between the three products and the impact of cannabis sales beginning in 2014.²⁶ They found that the legalization and sale of cannabis in Washington reduced the demand for both alcohol (15%) and cigarettes (5%).²⁷ A separate study published by researchers at the National Research Institute for Child and Family Studies at Children's National Hospital and the University of Washington sought to isolate the effect on adolescent consumption of alcohol and tobacco.²⁸ To do so they analyzed data on reported use from 238 students attending three Tacoma area middle schools during Washington’s transition from legalized medical use of cannabis to legalized use by any adult.²⁹ They identified a significant decline in the number of students who reported that they smoked cigarettes (7.9%) or consumed alcohol (4.1%) after the state’s transition.³⁰

These topics merit continued study even though there appears to be a growing consensus, given the potential public health benefit or harm if these substances are substitutes. For example, two of the studies cited above specifically find a reduction in tobacco use among minors, and a substitution would hint at potentially increased cannabis use in minors, even though such use is still illegal in every state.³¹ Within these two studies, one finds a not statistically significant increase in cannabis use among minors and the other finds no impact except for a reduction in frequent use.³² Either way, whether it is a gain or loss for public health if people switch from tobacco to cannabis depends on the relative health risks of each substance, itself a matter still being sorted out by researchers and one that is beyond the scope of this policy brief.

Medical: A potential substitution effect of medical can-

nabis for alcohol and tobacco has been studied less extensively. The current body of literature seems to show at least a marginal substitution of medical cannabis for tobacco products.³³ The most recent study is from 2019 and found that medical marijuana laws reduced both the number of adults smoking cigarettes and the number smoked by current smokers.³⁴ The impact on alcohol use is much less clear given a near-equal split between studies finding a reduction in alcohol consumption and others finding no relationship.³⁵ For example, two studies from 2020 both looked at this question and reached contradictory conclusions. Michele Baggio and his co-authors analyzed retail sales data provided by Nielsen and determined that alcohol sales decreased by 12.4% in counties that adopted a medical cannabis law.³⁶ Another group of researchers from Washington University analyzed tax receipts data to conclude there was no association between medical cannabis legalization and alcohol sales.³⁷ This outcome means that we would caution against any strong conclusions based on the existing research.

Decriminalization: The impact of cannabis decriminalization has been studied only a few times, as we have seen with other topics of interest in this study. These studies are all from the late 1990s and early 2000s but indicate such policies reduce alcohol consumption in those jurisdictions.³⁸ Reliance on these studies is likely imprudent, though, given the number of states that since then have legalized cannabis in some form.

Use of Opioids and Illicit Drugs

A similar substitution might occur between cannabis and other drugs, including opioids. If it does, it could be a benefit to Wisconsin, which has seen annual drug overdose deaths increase by more than 100% since 2014, driven by a more than 125% increase in opioid overdose deaths.³⁹ The CDC notes that it “is unlikely” for anyone to overdose on cannabis; the agency does not track overdose deaths for marijuana or any marijuana derivative.⁴⁰ This possibility to reduce overdoses and deaths from potentially more dangerous substances is another tradeoff that leaders need to consider.

Adult use: Research on a substitution effect focused on

opioids is very strong, reaching a near-consensus that the legalization of cannabis has reduced opioid prescribing, misuse, overdoses and deaths.⁴¹ A study by Samantha Marinello of traffic fatalities, discussed in an earlier report in this series, also looked at opioid overdose deaths. She and her coauthors concluded that legalization in the first seven states reduced opioid overdose fatalities by an average of 11%.⁴² Several case studies on individual patients analyze the impact of cannabis use on opioid use and misuse.⁴³ These reach a conclusion that comports with population-level studies of legal changes: that cannabis can serve as an effective substitute for opioids.

The impact of adult use legalization on other illicit drugs, such as cocaine, opioids and methamphetamine, is much less clear. Some studies conclude that it will reduce the use of other drugs, while others find that it will increase or have no impact.⁴⁴ A group of economists led by Davide Dragone at the University of Bologna explored county-level data from Washington and Oregon to determine how adult use legalization affected drug consumption in those two states.⁴⁵ They concluded that this policy change resulted in a decrease in the consumption of all other drugs among both youth and adults.⁴⁶ Contradicting that finding is a study from Claire E. Blevins and colleagues that explored different data from Washington to conclude that adult use legalization resulted in no increase or decrease in the use of other drugs.⁴⁷ More research is needed before a definitive conclusion can be reached.

Medical: The legalization of cannabis for medical use could also have a big impact on the opioid crisis, especially among those who begin using opioids legally. Researchers who have studied similar metrics to those discussed above have concluded that allowing cannabis for medical use will reduce the prescribing and use of opioids⁴⁸ but the conversion of that reduction to reduced deaths and overdoses is much less clear in the current research.⁴⁹ Recent findings from researchers at Harvard Medical School and the University of Kentucky used data from employer-sponsored health insurance programs in all 50 states to find that such laws are associated with a 7% reduction in the prescription of morphine and an overall reduction in opioid prescriptions across

the board.⁵⁰ Other work released less than a year later by researchers from Columbia University raised questions about the impact on a related metric — opioid overdoses — by concluding that medical cannabis did not impact the rate of opioid overdoses between 2000 and 2011 in states with medical cannabis laws after controlling for other factors.⁵¹ This division in the research means that we are able to confidently conclude only that the adoption of a medical cannabis market in Wisconsin will reduce opioid use and not necessarily opioid overdoses.

Similar to adult use laws, the impact of medical cannabis legalization on the use of other illicit drugs is unclear and has been studied to a lesser extent. The four existing studies tend to indicate that it might reduce the use of other illicit

drugs among adults, but there is not enough evidence to draw any conclusions about the potential impact on youth.⁵²

Conclusion

There are still many open questions when it comes to the legalization of cannabis and its impact on cannabis use disorder and the use of other substances. Some research shows that such policies could have a positive public health impact by reducing cannabis use disorder and the use of other illicit drugs, but other studies show the contrary. The experience of other states so far shows only that opioid use and alcohol consumption will be reduced in states that adopt policies allowing the adult use of cannabis. A more concrete consensus will have to await further research.



About the author

Jeremiah Mosteller is an attorney and criminal justice policy expert who is a visiting fellow at the Badger Institute. He also serves as a policy director at Americans for Prosperity, where he supports the organization's efforts to

advance policies that expand freedom and opportunity in 36 states and Congress. Mosteller leads a team of policy experts who focus on policies that advance public safety, border security, free speech, and national security. As part of this role, Mosteller has worked with conservatives across the country to shape state and federal marijuana policies that respect conservative principles like low taxes, free markets, competition, federalism, and the rule of law.

About this project

Mosteller is part of a team at the Badger Institute with varying and sometimes conflicting personal perspectives and affiliations working together to review existing academic literature on the ramifications of marijuana legalization in other states. The goal of our reports is to be as objective and thorough as possible and simply synthesize what others have found. We encourage feedback and suggestions from anyone who thinks we may have missed any relevant findings. The Badger Institute has not taken a position on legalization in any form and may or may not do so in the future.

Endnotes

1: Substance Abuse and Mental Health Services Administration, National Survey on Drug Use and Health, Substance Abuse and Mental Health Services Administration (2023), <https://www.samhsa.gov/data/nsduh/national-releases> (see Table 5.1 in the annual national reports).

2: Increased: Deborah S. Hasin, et al., State Cannabis Legalization and Cannabis Use Disorder in the US Veterans Health Administration, 2005 to 2019, 80 JAMA Psychiatry 380 (2023); Jason R. Kilmer, et al., Cannabis Use Among Young Adults in Washington State After Legalization of Nonmedical Cannabis, 112 Amer. J. Public Health 638 (2022) (finding that cannabis use disorder increased in Washington among adults aged 18-25 years of age after the state legalized adult use cannabis); Magdalena Cerda, et al., Association Between Recreational Marijuana Legalization in the United States and Changes in Marijuana Use and Cannabis Use Disorder From 2008 to 2016, 77 JAMA Psychiatry 165 (2020) (finding that cannabis use disorder increase by 25% more among those aged 12-17 in states with adult use legalization compared to those without, less significantly for those older than 26 years of age, and did not impact it for those aged 18-25 years old); Claire E Blevins, et al., The Implications of Cannabis Policy Changes in Washington on Adolescent Perception of Risk, Norms, Attitudes, and Substance Use, 12 Substance Abuse Res. Treatment 1 (2018) (finding that reported cannabis use disorder symptoms increased in Seattle after Washington legalized adult use of cannabis).

Decreased: Ellen T. Kurtzman & Burt S. Barnow, The impact of recreational cannabis laws on cannabis use disorder during “treat and release” visits to hospital emergency departments in four U.S. states, 2017–2020, 36 Preventative Med. Rep. 1 (2023); Jeremy Mennis, et al., Recreational cannabis legalization alters associations among cannabis use, perception of risk, and cannabis use disorder treatment for adolescents and young adults, 138 Addictive Behaviors 1 (2023) (finding that adolescent admission to treatment for cannabis use declined in Colorado and Washington post-legalization to significantly below the admission rate in non-legalization states, but authors note this could be because of decreased perceptions in harmfulness).

No change: Rahi Abouk, et al., Pain Management and Work Capacity: Evidence from Workers’ Compensation and Marijuana Legalization, 42 J. Pol’y Analysis Management 737 (2023) (finding that the adoption of an adult use cannabis law is not associated with higher admission to substance use disorder treatment for marijuana or other drugs); Taeho Greg Rhee & Robert A. Rosenheck, Admissions to substance use treatment facilities for cannabis use disorder, 2000–2017: Does legalization matter?, 31 Amer. J. Addictions 423 (2022) (finding that legalization of cannabis had no impact on marijuana-associated admissions to substance use treatment).

See also Lydia Aletraris, et al., Assessing the Impact of Recreational Cannabis Legalization on Cannabis Use Disorder and Admissions to Treatment in the United States, 10 Current Addiction Rep. 198 (2023) (finding that the body of existing research is mixed but generally indicates an increase in cannabis use disorder among both adults and youth post-legalization of cannabis; no association was found with treatment admissions); Jessica L. Bourdon, et al., The effect of cannabis policies on treatment outcomes for cannabis use among U.S. adults, 131 J. Substance Abuse Treatment 1 (2021) (finding that cannabis legalization does not impact the length of stay or treatment completion for cannabis use disorder treatment); Rosanna Smart & Rosalie Liccardo Pacula, Early evidence of the impact of cannabis legalization on cannabis use, cannabis use disorder, and the use of other substances: Findings from state policy evaluations, 45 Amer. J. Drug Alcohol Abuse 644 (2019) (finding that the research is mixed on whether cannabis legalization increases cannabis use disorder); Louise Destrée, et al., Exploring the association of legalisation status of cannabis with problematic cannabis use and impulsivity in the USA, 7 Drugs Context 1 (2018) (finding that the problematic cannabis use among 329 users was no different in states with legalization and those without it).

3: Hasin, supra note 2.

4: Hasin, supra note 2.

5: Kurtzman, supra note 2.

6: Kurtzman, supra note 2.

7: Kurtzman, supra note 2; Mennis, supra note 2.

8: Increase: Hasin, supra note 2 (finding that both states with no cannabis legalization and those with medical legalization saw increases in cannabis use disorder but that medical legalization accounted for 4.7% of the increase in states with that policy); Deborah S. Hasin, et al., US Adult Illicit Cannabis Use, Cannabis Use Disorder, and Medical Marijuana Laws, JAMA Psychiatry (2017), <https://jamanetwork.com/journals/jamapsychiatry/article-abstract/2619522>; Hefei Wen, et al., The effect of medical marijuana laws on adolescent and adult use of marijuana, alcohol, and other substances, 42 J. Health Econ. 64 (2015) (finding the implementation of medical cannabis law is associated with a 10% increase in the probability of cannabis abuse or dependence).

No change: Guillaume Barbalat & Sze Liu, Long-Term Impact of Medical Marijuana Laws on the Burden of Cannabis Use Disorders in US Male and Female Adolescents and Young Adults, 59 Community Mental Health J. 391 (2023); Destrée, supra note 2 (finding that the problematic cannabis use among 329 users was no different in states with medical cannabis legalization and those without it).

See also Jessica L. Bourdon, et al., The effect of cannabis policies on treatment outcomes for cannabis use among U.S. adults, 131 J. Substance Abuse Treatment 1 (2021) (finding that medical cannabis legalization does not impact the length of stay or treatment completion for cannabis use disorder

treatment).

9: Hasin, supra note 8 (2017).

10: Hasin, supra note 8 (2017).

11: Barbalat, supra note 8.

12: Barbalat, supra note 8.

13: Jeremy Mennis, et al., Cannabis Legalization and the Decline of Cannabis Use Disorder (CUD) Treatment Utilization in the US, 10 *Current Addiction R.* 39 (2023) (finding that rate of treatment among those with a cannabis use disorder is declining); Mennis, supra note 2 (2023a); See also Jeremy Mennis & Gerald J. Stahler, Adolescent treatment admissions for marijuana following recreational legalization in Colorado and Washington, 210 *Drug Alcohol Dependence* 1 (2020) (finding that adolescent admission to treatment for cannabis use declined in Colorado and Washington post-legalization to significantly below the admission rate in non-legalization states but authors note this could be because of decreased perceptions in harmfulness).

14: See generally Maia Szalavitz, Why we should de-criminalize all drugs, *Guardian* (2016), <https://www.theguardian.com/us-news/commentisfree/2016/jul/05/why-de-criminalize-all-drugs-stigma>.

15: Substance Abuse and Mental Health Services Administration, supra note 1 (Table 1.1B).

16: At the end of last century, the National Academy of Sciences rejected that there was a proven causal relationship because of the lack of empirical research exploring the question. See Janet E. Joy, et al., National Academy of Sciences, MARIJUANA AND MEDICINE: ASSESSING THE SCIENCE BASE (1998) (“There is no conclusive evidence that the drug effects of marijuana are causally linked to the subsequent abuse of other illicit drugs. ... There is no evidence that marijuana serves as a steppingstone on the basis of its particular physiological effect.”)

17: Ángel García-Pérez, et al., Testing the cannabis gateway hypothesis in a national sample of Spanish adolescents, 144 *Addiction* 1 (2023); Isaac C. Rhew, et al., The association between cannabis use and risk of non-medical pain reliever misuse onset among young adults in a legal cannabis context, 143 *Addictive Behaviors* 1 (2023); Cody Jorgensen & Jessica Wells, Is marijuana really a gateway drug? A nationally representative test of the marijuana gateway hypothesis using a propensity score matching design, *J. Exp. Criminology* (2021); Johannes Thrul, et al., Adolescent cannabis and tobacco use are associated with opioid use in young adulthood—12-year longitudinal study in an urban cohort, 116 *Addiction* 643 (2020); Brian J. Fairman, et al., When Marijuana Is Used before Cigarettes or Alcohol: Demographic Predictors and Associations with Heavy Use, Cannabis Use Disorder, and Other Drug-related Outcomes, 20 *Prevention Sci.* 225 (2019); James McCutcheon & Stephen Watts, An Examination of the Importance of Strain in the Cannabis Gateway Effect, 62 *Int'l J Offender Therapy Comparative Criminology* 3603 (2018); Stephen Nkansah-Amankra & Mark Minelli, “Gateway hypothesis” and early drug use: Additional findings from tracking a population-based sample of adolescents to adulthood, 4 *Prevent. Med. Reports* 134 (2016); Roberto Secades-Villa, et al., Probability and predictors of the cannabis gateway effect: A national study, 26 *Int'l J. Drug Pol'y* 135 (2015); Megan O'Brien, et al., Does cannabis onset trigger cocaine onset? A case-crossover approach, 21 *Int'l J. Methods Psychiatric Res.* 66 (2012); Louisa Degenhardt, et al., Evaluating the drug use “gateway” theory using cross-national data: Consistency and associations of the order of initiation of drug use among participants in the WHO World Mental Health Surveys, 108 *Drug Alcohol Depend.* 845 (2010); Karen Van Gundy, et al., A Life-course Perspective on the “Gateway Hypothesis”, 51 *J. Health Social Behav.* 244 (2010); Andrew R Morral, et al., Reassessing the marijuana gateway effect, 97 *Addiction* 1493 (2002).

18: García-Pérez, supra note 17 (finding that cannabis use doubled the likelihood of future tobacco or alcohol use and increased the likelihood of future illicit drug use five times among a sample of Spanish adolescents); Thrul, supra note 17 (finding “more frequent use of cannabis or tobacco at age 14 was associated with more frequent use of opioids at age 19”); O'Brien, supra note 17 (finding “the month of cannabis onset now represents a month of modestly but statistically robust excessive risk of starting cocaine use, even if cannabis per se is not a cause of cocaine use” or other factors cause the substitution or addition of cocaine to someone’s drug use habits); Fairman, supra note 17 (finding “those who start with marijuana or with alcohol are equally more likely to subsequently use other drugs, such as cocaine, heroin, inhalants, or non-medical prescription drugs, compared to a lower likelihood for those who start with cigarettes or other tobacco products”); But see Jorgensen, supra note 17 (finding a weak association between heavy cannabis use and future illicit drug equal to tobacco and alcohol use in 6 of 18 tests completed in the study, with the authors concluding that a “causal association between marijuana use and hard drug use was largely unfounded in the current study”); See also Jack Wilson, et al., Weeding out the truth: a systematic review and meta-analysis on the transition from cannabis use to opioid use and opioid use disorders, abuse or dependence, 117 *Addiction* 284 (2022) (finding that prior cannabis use resulted in a 2.76 times greater likelihood that person would use opioids later in life but noting that the studies included in the review of the research were “of low quality and with a moderate risk of bias”); Joseph J. Sabia, et al., Is Recreational Marijuana a Gateway to Harder Drug Use and Crime?, National Bureau of Economic Research (2021), <https://www.nber.org/papers/w29038> (“Across analyses of four national datasets [the NSDUH, the UCR, the NVSS Mortality Files, and the TEDS] we find little consistent evidence, at least thus far, of important gateway effects of RMLs. While RMLs are associated with increases in adult marijuana use and a reduction in marijuana-related arrests, we find little compelling evidence to suggest that RMLs result in increases in illicit drug use, arrests for part I offenses, drug-involved overdoses, or drug-related treatment admissions for addiction.”).

19: McCutcheon, supra note 17 (finding that each use of cannabis increased the likelihood of trying other illicit substances by 1.55% but when researchers controlled for 10 measures of stress in the individual’s life that causal relationship disappeared); Secades-Villa, supra note 17 (finding that 44.7% of individuals who use cannabis in their lifetime will use another illicit drug in the future but finding that other factors predicted that transition, factors such as being male, living in an urban area, and having a psychiatric disorder); Degenhardt, supra note 17 (analyzed drug use data from 17 different countries to conclude that subsequent substance use was driven by factors other than prior use of certain substances – including cannabis – and identi-

fying national patterns where the use of other illicit substances preceded cannabis use); Gundy, *supra* note 17 (finding that the causal relationship between teen cannabis use and other illicit drug abuse “becomes nonsignificant” when they controlled for stress levels and life events); Morral, *supra* note 17 (finding that once someone has a general propensity to use drugs, any difference in risk of hard drug use between those using or not using cannabis disappears); But see Rhew, *supra* note 17 (finding that use of medical or adult use cannabis products is associated with misuse of non-medical pain relievers even when you control for alcohol and tobacco use); Nkansah-Amankra, *supra* note 17 (finding that use of cannabis early in life increased the likelihood of using cocaine and other illegal drugs but noting that an individual having depressive symptoms contributes significantly to the relationship).

20: Degenhardt, *supra* note 17; Hudson Reddon, et al., Cannabis use is associated with lower rates of initiation of injection drug use among street-involved youth: A longitudinal analysis, 37 *Drug Alcohol Rev.* 421 (2018) (finding that “cannabis use was associated with slower time to initiation of injection drug use” among a group of 481 youth in Canada and noting that “[t]his finding challenges the view of cannabis as a gateway substance that precipitates the progression to using harder and more addictive drugs”).

21: Joy, *supra* note 16.

22: See *generally* Katarina Guttmannova, et al., Impacts of Changing Marijuana Policies on Alcohol Use in the United States, 40 *Alcoholism* 33 (2016).

23: Decrease: Charles B. Fleming, et al., Trends in Alcohol, Cigarette, E-Cigarette, and Nonprescribed Pain Reliever Use Among Young Adults in Washington State After Legalization of Nonmedical Cannabis, 1 *J. Adolescent Health* 1 (2022) (finding that alcohol use and heavy drinking declined among 18- to 25-year-olds between 2014 and 2019 after Washington legalized adult use of cannabis); Keaton Miller & Boyoung Seo, The Effect of Cannabis Legalization on Substance Demand and Tax Revenues, 75 *Nat’l Tax J.* 107 (2021) (finding that legalization of adult use cannabis in Washington resulted in a 15% decrease in alcohol demand); Collin M. Calvert & Darin Erickson, Recreational cannabis legalization and alcohol purchasing: a difference-in-differences analysis, 3 *J. Cannabis Res.* 1 (2021) (finding that legalization of adult use cannabis was associated with a 16% decline in overall monthly alcohol purchases in Colorado, a 12% decrease in wine and 25% increase in spirits purchases each month in Washington, and a small decline in monthly spirits demand in Oregon); Zoe M. Alley, et al., Trends in college students’ alcohol, nicotine, prescription opioid and other drug use after recreational marijuana legalization: 2008–2018, 102 *Addictive Behav.* 1 (2020) (finding that binge drinking declines among college students older than 21 years of age after the adoption of adult use cannabis legalization); Davide Dragone, et al., Crime and the legalization of recreational marijuana, 159 *J. Econ Behav. Org.* 488 (2019) (finding a decrease in binge drinking following legalization); Meenakshi S. Subbaraman & William C. Kerr, Subgroup trends in alcohol and cannabis co-use and related harms during the rollout of recreational cannabis legalization in Washington state, 75 *Int’l J. Drug. Pol’y* 1 (2020) (finding that the amount of alcohol consumed by men declined after the legalization of cannabis in Washington and that both the number of alcohol-related and financial harms experienced by women also declined); W. Alex Mason, et al., Prevalence of marijuana and other substance use before and after Washington State’s change from legal medical marijuana to legal medical and nonmedical marijuana: Cohort comparisons in a sample of adolescents, 37 *Substance Abuse* 330 (2016) (finding that the transition from medical to adult use cannabis in Washington state was associated with a significant decline in the percentage of middle school students reporting they smoked cigarettes [7.9%] or consumed alcohol [4.1%]).

Increase: Vandana Macha, et al., Association of Recreational Cannabis Legalization With Alcohol Use Among Adults in the US, 2010 to 2019, 3 *JAMA Health Forum* 1 (2022) (finding that adult use cannabis legalization increased overall alcohol consumption by 0.9% but did not impact binge or heavy drinking, with the impact driven by those aged 18–24); Thanh Lu, Marijuana legalization and household spending on food and alcohol, 30 *Health Econ.* 1684 (2021) (finding that adoption of recreational marijuana resulted in a 9% increase in quarterly spending on alcohol); Jennifer A. Bailey, et al., Marijuana Legalization and Youth Marijuana, Alcohol, and Cigarette Use and Norms, 59 *Amer. J. Prev. Med.* 309 (2020) (finding that legalization of marijuana increased the likelihood a minor had consumed alcohol in the past year).

No impact: Emily Kan, et al., Impact of recreational cannabis legalization on cannabis use, other substance use, and drug-related offending among justice-system-involved youth, 40 *Behav. Sci. L.* 292 (2022) (finding no impact on alcohol use frequency post-legalization of cannabis in California); Rebekah Levine Coley, et al., Recreational Marijuana Legalization and Adolescent Use of Marijuana, Tobacco, and Alcohol, 69 *J. Adolescent Health* 41 (2021) (finding that legalization was not associated with increased use of alcohol); Sirish Veligati, et al., Changes in alcohol and cigarette consumption in response to medical and recreational cannabis legalization: Evidence from U.S. state tax receipt data, 75 *Int’l J. Drug Pol’y* 1 (2020) (finding that there was no impact on alcohol sales per capita from cannabis legalization); Ashley Brooks-Russell, et al., Adolescent Marijuana Use, Marijuana-Related Perceptions, and Use of Other Substances Before and After Initiation of Retail Marijuana Sales in Colorado (2013–2015), 20 *Prevention Sci.* 185 (2019) (finding that adult use legalization in Colorado resulted in no change in the use of alcohol among high school students); Blevins, *supra* note 2 (finding no increase or decrease in the use of alcohol after adult use cannabis legalization in Washington).

See *also* Hollis C. Karoly, et al., Effects of cannabis use on alcohol consumption in a sample of treatment-engaged heavy drinkers in Colorado, 116 *Addiction* 2529 (2021) (finding that use of cannabis among those being treated for alcohol consumption resulted in them having 29% fewer drinks and reduced their likelihood of binge-drinking by more than 2 times); Constanza Rizzo, et al., Does cannabis complement or substitute alcohol consumption? A systematic review of human and animal studies, 34 *J. Psychopharmacology* 938 (2020) (reviewing 64 studies examining whether cannabis and alcohol are substitutes or complement; finding that 30 studies found substitution, 17 found complementary use, 14 found neither, and four found evidence for both); Benjamin Hansen, Are Marijuana and Alcohol Substitutes?, The Center for Growth and Opportunity (2019), <https://www.thecgo.org/research/are-marijuana-and-alcohol-substitutes/> (concluding that marijuana and alcohol are substitutes after analyzing data on car crashes involving alcohol in Idaho after Washington legalized cannabis use).

24: Decrease: Dhaval Dave, et al., Have recreational marijuana laws undermined public health progress on adult tobacco use?, 90 *J. Health Econ.* 1 (2023) (finding that adult use marijuana legalization is associated with a reduction in adult cigarette smoking and vape usage); Fleming, *supra* note 23 (finding that cigarette use declined among 18- to 25-year-olds between 2014 and 2019 after Washington legalized adult use of cannabis); Kan, *supra*

note 23 (2022) (finding that cigarette use frequency was lower in California post-legalization of cannabis than in Pennsylvania, which has not legalized cannabis for recreational use); Miller, supra note 23 (finding that legalization of adult use cannabis in Washington resulted in a 5% decrease in tobacco demand); Brooks-Russell, supra note 23 (finding a 28% decrease in cigarette smoking among Colorado high school students after adult use legalization); Mason, supra note 23 (finding that the transition from medical to adult use cannabis in Washington state was associated with a significant decline in the percentage of middle school students reporting they smoked cigarettes [7.9%] or consumed alcohol [4.1%]).

Increase: Coley, supra note 23 (finding that legalization of recreational cannabis was associated with a 9% increase in the likelihood teens used an e-cigarette in the past month but did not impact the level/rate of use; also found that legalization was not associated with increased use of cigarettes); See also Ashutosh Bhavé & B. P. S. Murthi, A Study of the Effects of Legalization of Recreational Marijuana on Sales of Cigarettes, SSRN (2021), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3508422 (working paper that found that legalization of adult use cannabis in Colorado was associated with a 7% increase in cigarette consumption).

No impact: Veligati, supra note 23 (finding that there was no impact on cigarette sales per capita from cannabis legalization); Bailey, supra note 23 (finding that legalization of marijuana had no impact on cigarette use).

25: Miller, supra note 23.

26: Miller, supra note 23 at 113-117.

27: Miller, supra note 23 at 128.

28: Mason, supra note 23.

29: Mason, supra note 23 at 331.

30: Mason, supra note 23 at 333.

31: Brooks-Russell, supra note 23; Mason, supra note 23.

32: Brooks-Russell, supra note 23 (finding that neither lifetime or past 30-day use of cannabis increased post-legalization in Colorado but a significant decline in frequent use and use on school property): Mason, supra note 23 (finding that that transition from medical to adult use cannabis in Washington was associated with a non-statistically significant increase in reported cannabis use).

33: Anna Choi, et al., Smoke Gets in Your Eyes: Medical Marijuana Laws and Tobacco Cigarette Use, 5 Amer. J. Health Econ. 303 (2019); Coley, supra note 23 (finding that legalization of medical cannabis was associated with a reduced likelihood that teens used an e-cigarette in the past month); But see Veligati, supra note 23 (finding that there was no impact on cigarette sales per capita from medical cannabis legalization); See also Abhery Das, et al., State Medical Marijuana Laws and Initiation of Cigarettes among Adolescents in the U.S., 1991-2015, Research Society on Marijuana (2021), <https://publications.sciences.ucf.edu/cannabis/index.php/Cannabis/article/view/90> (finding that adoption of medical cannabis law is associated with a lower chance across all ages that a minor will begin using cigarettes).

34: Choi, supra note 33.

35: Michele Baggio, et al., Marijuana and alcohol: Evidence using border analysis and retail sales data, 53 Can. J. Econ. 563 (2020); Joseph Sabia, et al., The Effect of Medical Marijuana Laws on Body Weight, 26 Health Econ. 6 (2017) (finding that medical marijuana results in a 3.1% reduction in alcohol consumption and a 4.8% reduction in binge drinking); D. Mark Anderson, et al., Medical Marijuana Laws, Traffic Fatalities, and Alcohol Consumption, 56 J. L. Econ. 333 (2013) (finding that adoption of a medical marijuana law is associated with a 5% decline in beer consumption, a small decline in wine sales, and a 13.2% decline in traffic fatalities involving alcohol); But see Veligati, supra note 23; Wen, supra note 8 (finding that implementation of a medical cannabis law is not associated with changes in overall alcohol consumption but is associated with a 10% increase in binge drinking days).

36: Baggio, supra note 35 at 579-580.

37: Veligati, supra note 23.

38: Frank J. Chaloupka & Adit Laixuthai, Do Youths Substitute Alcohol and Marijuana? Some Econometric Evidence, 23 Eastern Econ. J. 253 (1997) (finding that decriminalization is associated with less frequent alcohol use and a lower likelihood that individuals will engage in heavy drinking); Tetsuji Yamada, et al., The impact of alcohol consumption and marijuana use on high school graduation, 5 Health Econ. 77 (1996) (finding that marijuana decriminalization reduces the probability that high school students become frequent alcohol drinkers); But see J. Williams, et al., Alcohol and marijuana use among college students: economic complements or substitutes?, 13 Health Econ. 825 (2004) (finding a statistically insignificant relationship between marijuana decriminalization and alcohol consumption).

39: Wisconsin Department of Health Services, Substance Use: Drug Overdose Deaths Dashboard, Wisconsin Department of Health Services (2023), <https://www.dhs.wisconsin.gov/aoda/drug-overdose-deaths.htm>.

40: Centers for Disease Control and Prevention, Drug Overdose Deaths, U.S. Department of Health and Human Services (2022), <https://www.cdc.gov/drugoverdose/data/statedeaths.html>; Centers for Disease Control, Is it possible to “overdose” or have a “bad reaction” to marijuana?, Centers for Dis-

ease Control (2018), <https://www.cdc.gov/marijuana/faqs.htm>.

41: Mir. M. Ali, et al., Recreational marijuana laws and the misuse of prescription opioids: Evidence from National Survey on Drug Use and Health microdata, 32 *Health Econ.* 277 (2023) (finding that adoption of an adult use cannabis law reduced the likelihood of misusing prescription opioids but that effect dissipates over the next two to three years); Alvaro Castillo-Carniglia, et al., Changes in Opioid and Benzodiazepine Poisoning Deaths After Cannabis Legalization in the US: A County-level Analysis, 2002–2020, 34 *Epidemiology* 467 (2023) (finding that legalization of adult use cannabis was associated with reduced opioid and benzodiazepine poisonings); Samantha Marinello & Lisa Powell, The impact of recreational cannabis markets on motor vehicle accident, suicide, and opioid overdose fatalities, *Soc. Sci. Med.* (2023); Abouk, supra note 2 (finding that opioid prescriptions declined by between 7.3% and 9.8% following adult use cannabis legalization); Fleming, supra note 23 (finding that opioid use declined among 18- to 25-year-olds between 2014 and 2019 after Washington legalized adult use of cannabis);



Shyam Raman, et al., Recreational cannabis and opioid distribution, 32 *Health Econ.* 747 (2023) (finding that an adult use cannabis law leads to a reduction in codeine dispensing at retail pharmacies); Wen, supra note 8 (finding that adult use cannabis laws were associated with a 13% reduction in the prescription of morphine among patients in employer-sponsored health insurance programs); Michelle N. Anyaehie, et al., Opioid distribution trends in California post recreational marijuana legalization, 74 *Guthrie J.* 35533 (2022) (comparing California and Texas to find reductions in cumulative opioid distribution and a significantly slower increase in heroin overdoses); Coleman Drake, et al., Recreational cannabis laws and opioid-related emergency department visit rates, 30 *Health Econ.* 2595 (2021) (finding that adoption of adult use cannabis decreases opioid-related emergency room visits by 7.6% for six months after implementation); J.J. Alcocer, Exploring the effect of Colorado’s recreational marijuana policy on opioid overdose rates, 185 *Public Health* 8 (2020) (finding that legalization of adult use cannabis in Colorado caused a 5% reduction in opioid overdose deaths); Benjamin J. McMichael, et al., The impact of cannabis access laws on opioid prescribing, 69 *J. Health Econ.* 1 (2020) (finding adult use cannabis laws reduced prescriptions of morphine by 11.8% and reduced the prescription of all opioids in general); Nathan W. Chan, et al., The Effects of Recreational Marijuana Legalization and Dispensing on Opioid Mortality, 58 *Econ. Inquiry* 589 (2020) (finding adoption of adult use cannabis is associated with a 20% to 35% reduction in annual opioid mortality); Amalie K. Kropp Lopez, et al., Prescription Opioid Distribution after the Legalization of Recreational Marijuana in Colorado, 17 *Int’l J. Environ. Res. Public Health* 1 (2020) (finding significantly higher reductions in pain reliever prescriptions in Colorado [31.5%] when compared to Maryland [12.2%] and Utah [23.5%] following the legalization of adult use cannabis); Yuyan Shi, et al., Recreational marijuana legalization and prescription opioids received by Medicaid enrollees, 194 *Drug Alcohol Dependence* 13 (2019) (finding that prescriptions, total doses, and spending on Schedule III opioids were all reduced by more than 30% in states having adult use cannabis among Medicaid enrollees); Hefei Wen & Jason M. Hockenberry, Association of Medical and Adult use Marijuana Laws With Opioid Prescribing for Medicaid Enrollees, 178 *JAMA Intern. Med.* 673 (2018) (finding that adult use cannabis laws reduced opioid prescribing by 6.38%); Melvin D. Livingston, et al., Recreational Cannabis Legalization and Opioid-Related Deaths in Colorado, 2000–2015, 107 *Amer. J. Public Health* 1927 (2017) (finding that adoption of adult use cannabis in Colorado reduced opioid-related deaths by 0.7 per month); But see Neil Mathur & Christopher Ruhm, Marijuana legalization and opioid deaths, 88 *J. Health Econ.* 1 (2023) (finding that adult use cannabis legalization is potentially associated with increased opioid mortality); Archie Bleyer, et al., United States marijuana legalization and opioid mortality epidemic during 2010–2020 and pandemic implications, 114 *J. Nat’l Med. Assoc.* 412 (2022) (finding that the opioid mortality rate increased more rapidly in states with adult use cannabis laws than those without after 2012 and that such an outcome holds across all racial demographic groups); Lynn M. Neilson, et al., Impact of Marijuana Legalization on Opioid Utilization in Patients Diagnosed with Pain, 36 *J. Gen. Internal Med.* 3417 (2021) (finding that patients living in an adult use cannabis state were more likely to receive an initial opioid prescription, a follow-up prescription, and a greater than 90 days follow-up supply); See also Kayla N. Tormohlen, et al., The State of the Evidence on the Association Between State Cannabis Laws and Opioid-Related Outcomes: A Review, 8 *Current Addiction Reports* 538 (2021) (reviewing the conclusions of 21 past studies and finding mixed results for adult use legalization impact on opioid prescriptions); Greta Hsu & Balázs Kovács, Association between county level cannabis dispensary counts and opioid related mortality rates in the United States: panel data study, *BMJ* (2021), <https://www.bmj.com/content/372/bmj.m4957.abstract> (finding that the number of medical or adult use dispensaries in a county is associated with a reduction in opioid mortality; an increase from one to two dispensaries is associated with a 17% reduction in opioid-related mortality); William C. Bryson, et al., Cannabis Use and Nonfatal Opioid Overdose among Patients Enrolled in Methadone Maintenance Treatment, 56 *Substance Use Misuse* 697 (2021) (finding that likelihood of a self-reported non-fatal overdose was 71% lower among individuals who use cannabis in the past month); Sunday Azagba, et al., Trends in Opioid Misuse among Marijuana Users and Non-Users in the U.S. from 2007–2017, 16 *Int’l J. Environ. Res. Public Health* 1 (2019) (finding that opioid prescriptions declined faster among cannabis users over non-users); Joseph Sabia, et al., Is Recreational Marijuana a Gateway to Harder Drug Use and Crime?, *NBER* (2021), <https://www.nber.org/papers/w29038> (finding that adoption of an adult use cannabis law reduced opioid-related overdose deaths by up to 35.2%).

42: Marinello, *supra* note 41.

43: Trang Nguyen, et al., Changes in Prescribed Opioid Dosages Among Patients Receiving Medical Cannabis for Chronic Pain, New York State, 2017-2019, 6 *JAMA* 1 (2023) (analyzed more than 8,100 patients to find that patients who use medical cannabis for a longer duration saw reduced opioid dosages of up to 51% versus only 14% for those not using medical cannabis); Carolyn E. Pritchett, et al., Medical Cannabis Patients Report Improvements in Health Functioning and Reductions in Opiate Use, 57 *Substance Use Misuse* 1883 (2022) (study of more than 2,100 medical cannabis patients in Florida found that 79% either reduced or ceased use of other pain medication); Sarah S. Stith, et al., Effects of Legal Access to Cannabis on Scheduled II–V Drug Prescriptions, 19 *J. Amer. Medical Directors Assoc.* 59 (2018) (finding that chronic pain patients who used medical cannabis had a lower number of drug prescriptions, lower number of dates upon which prescriptions were filled, and a lower number of prescribing providers); Jacob M. Vigil, et al., Associations between medical cannabis and prescription opioid use in chronic pain patients: A preliminary cohort study, 12 *PLOS One* 1 (2017) (finding that medical cannabis use was associated with a higher likelihood of ceasing opioid prescription use and reduced daily dosage among a cohort of 66 patients); But see Di Lang, et al., Medical and non-medical cannabis use and risk of prescription opioid use disorder: Findings from propensity score matching, 38 *Drug Alcohol Rev.* 597 (2019) (finding that both medical and recreational cannabis use were associated with increased opioid misuse, but only recreational use was associated with increased opioid use disorder).

44: Guangzhen Wu & Roarke R. Cullenbine, Recreational marijuana legalization and drug-related offenses in Washington State: an interrupted time series analysis with a combination of synthetic controls, *J. Experimental Criminology* (2022) (finding that heroin, cocaine, and other illicit drug possession rates declined after Washington adopted adult use cannabis legalization); Dragone, *supra* note 23; But see Kan, *supra* note 23 (2022) (finding no impact on illicit drug use frequency post-legalization of cannabis in California); Jeremy Mennis, et al., Treatment admissions for opioids, cocaine, and methamphetamine among adolescents and emerging adults after legalization of recreational marijuana, 122 *J. Substance Abuse Treatment* 1 (2021) (finding that adult use legalization in Colorado and Washington did not impact treatment admissions for addiction to cocaine, opioids, or meth among adults or adolescents); Brooks-Russell, *supra* note 23 (finding that adult use legalization in Colorado resulted in no change in the use of prescription drugs or cocaine among high school students); Seong-min Park, et al., The Effect of Marijuana Legalization on the Trajectories of Hard Drug-Related Hospitalizations: A Growth Curve Analysis of the County-Level State Inpatient Database in Washington, 2009–2015, 50 *J. Drug Issues* 273 (2020) (finding that adult use cannabis legalization in Washington shifted the state from declining hard-drug hospitalizations to increasing hard-drug hospitalizations); Blevins, *supra* note 2; Alley, *supra* note 23 (finding that sedative misuse increased among minors after the adoption of adult use cannabis legalization); See also Sabia, *supra* note 18 *NBER* (2021) (finding that the legalization of adult use marijuana is associated with declines in overdose deaths from other illicit substances).

45: Dragone, *supra* note 23 at 491-494.

46: Dragone, *supra* note 23 at 495-498.

47: Blevins, *supra* note 2 at 3-4.

48: Yuhua Bao, et al., Medical Marijuana Legalization and Opioid- and Pain-Related Outcomes Among Patients Newly Diagnosed With Cancer Receiving Anticancer Treatment, 9 *JAMA Oncology* 206 (2023) (finding that medical cannabis legalization was associated with approximately 5.5% to 19.2% reduction in opioid dispensing among a cohort of more than 38,000 cancer patients); Jiebing Wen, et al., The impact of medical and recreational marijuana laws on opioid prescribing in employer-sponsored health insurance, 30 *Health Econ.* 989 (2021); McMichael, *supra* note 41 (finding that medical cannabis laws reduced prescriptions of morphine by 4.2% and reduced the prescription of all opioids in general); Jamie L. Flexon, et al., The effect of cannabis laws on opioid use, 74 *Int'l J. Drug Pol'y* 152 (2019) (finding that individuals in states with a medical cannabis law are less likely to report using a opioid); Anuj Shah, et al., Impact of Medical Marijuana Legalization on Opioid Use, Chronic Opioid Use, and High-risk Opioid Use, 34 *J. Gen. Internal Med.* 1419 (2019) (finding that medical marijuana legalization is associated with a reduction in both opioid prescriptions and high-risk opioid prescriptions); Wen, *supra* note 41 (2018) (finding that medical marijuana laws reduced opioid prescribing by 5.88%); Di Liang, et al., Medical cannabis legalization and opioid prescriptions: evidence on US Medicaid enrollees during 1993–2014, 113 *Addiction* 2060 (2018) (finding that medical cannabis legalization in the first 23 states reduced the number of prescription of Schedule III opioids by 29.6%, reduced the dosage of prescription for those drugs by 29.9%, and reduced total Medicaid spending on such drugs by 28.8%); Ashley Bradford & David Bradford, The Impact of Medical Cannabis Legalization on Prescription Medication Use and Costs under Medicare Part D, 61 *J. Law Econ.* 461 (2018) (Finding \$638.8 million in Medicare Part D savings from patients substituting medical marijuana for other prescription drugs); June H. Kim, et al., State Medical Marijuana Laws and the Prevalence of Opioids Detected Among Fatally Injured Drivers, 106 *Amer. J. Public Health* 2032 (2016) (finding that drivers aged 21-40 years old who died in a fatal car crash were less likely to test positive for opioids in a state with a medical cannabis law); But see Hillary Samples, et al., Association Between Legal Access to Medical Cannabis and Frequency of Non-Medical Prescription Opioid Use Among U.S. Adults, ___ *Int'l J. Mental Health Addiction* ___ (2023) (finding that legalization of cannabis for medical use is associated with an increase in occasional opioid use (2.1%) but reductions in regular (-0.6%) and frequent use (-1.5%)); Amanda C. Cook, et al., Does the legalisation of cannabis for medicinal use impact private health insurer prescription drug expenditures?, *The Geneva Papers on Risk and Insurance* (2023) (finding that medical cannabis legalization had no impact on health insurance expenditures for prescription drugs); Neilson, *supra* note 41 (finding that patients living in a medical cannabis state were more likely to receive an initial opioid prescription, a follow-up prescription, and a greater than 90 days follow-up supply); Mir M. Ali, et al., Medical Marijuana Laws, Marijuana Use, and Opioid-Related Outcomes among Women in the United States, 31 *Women's Health Issues* 24 (2021) (finding that a medical cannabis law was not associated with opioid misuse or opioid use disorder among all women, pregnant women, and female parents but was associated with a change in the frequency of opioid misuse for pregnant women [increase] and female parents [decrease]); Luis E. Segura, Association of US Medical Marijuana Laws With Nonmedical Prescription Opioid Use and Prescription Opioid Use Disorder, 2 *JAMA Netw. Open* 1 (2019) (finding no association between the adoption of medical cannabis and a change in opioid prescriptions); See also Lise DeShea, Medical Marijuana Legalization in Oklahoma: Effects on Neonatal Exposure to Opiates, ___ *Amer. J. Perinatology* ___ (2023) (finding that the number of babies born with a positive test for opioid exposure declined from 7.6% to 6.8% after Oklahoma legalized medical

marijuana); Ziemowit Bednarek, et al., U.S. cannabis laws projected to cost generic and brand pharmaceutical firms billions, 17 PLoS ONE 1 (2022) (finding that pharmaceutical companies lose \$2.4 billion dollars in annual sales for each state that legalizes medical cannabis); Carolyn E. Pritchett, et al., Medical Cannabis Patients Report Improvements in Health Functioning and Reductions in Opiate Use, 57 Substance Use Misuse 1883 (2022) (study of more than 2,100 medical cannabis patients in Florida found that 79% either reduced or ceased use of other pain medication); William C. Goedel, et al., Association of medical cannabis licensure with prescription opioid receipt: A population-based, individual-level retrospective cohort study, 100 Int'l J. Drug Pol'y 1 (2022) (finding that a doctor holding a medical cannabis license does not reduce the likelihood of filling an opioid prescription); Tormohlen, supra note 41 (reviewing the conclusions of 21 past studies and finding that all looking at medical cannabis found a reduction in opioid prescriptions and mixed results for adult use legalization); Stanford Chihuri & Guohua Li, State marijuana laws and opioid overdose mortality, 6 Injury Epidemiology 1 (2019) (finding that medical cannabis legalization was associated with a 7% reduction in opioid prescriptions when combining the findings of 16 past studies); Felipe Lozano-Rojas, et al., The Effect of Cannabis Laws on Access to Pain Medications among Commercially Insured Patients in the United States, SSRN (2022), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4299449 (finding that a medical cannabis law reduced the dispensing of prescription opioids – both the average daily supply dispensed and the average number of dispensed prescription per patient); Hayoung Cheon, et al., The Impact of Medical Marijuana Legalization on Opioid Prescriptions, SSRN (2021), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3917975 (finding that adoption of medical cannabis laws are associated with a reduction in quarterly prescriptions of opioids, the days of supply for opioid prescriptions, and the dosage strength of opioid prescriptions).

49: Castillo-Carniglia, supra note 41 (finding that legalization of medical cannabis and opening of dispensaries was associated with reduced opioid poisonings); Rhet A. Smith, The Effects of Medical Marijuana Dispensaries on Adverse Opioid Outcomes, 58 Econ. Inq. 569 (2020) (finding that opioid-related fatalities declined by 11% in counties after a medical cannabis dispensary opened); David Powell, et al., Do medical marijuana laws reduce addictions and deaths related to pain killers?, 58 J. Health Econ. 29 (2018) (finding that states adopting a medical cannabis law was associated with reduced deaths due to opioid overdose); Yuyan Shi, Medical marijuana policies and hospitalizations related to marijuana and opioid pain reliever, 173 Drug Alcohol Dependence 144 (2017) (finding that medical marijuana legalization is associated with a 23% reduction in hospitalizations related to opioid dependence or abuse and a 13% reduction in hospitalizations for opioid overdoses); Marcus A. Bachhuber, et al., Medical Cannabis Laws and Opioid Analgesic Overdose Mortality in the United States, 1999-2010, 174 JAMA Inter. Med. 1 (2014) (finding that a state with a medical cannabis law saw its annual opioid overdose mortality rate be 24.8% lower on average than states without one; the association of medical cannabis laws with lower opioid mortality was apparent in the first year after legalization and strengthened over time); But see Mathur, supra note 41 (finding that legalizing medical cannabis is associated with higher opioid mortality); June H. Kim, et al., Association between fatal opioid overdose and state medical cannabis laws in US national survey data, 2000-2011, 99 Int'l J. Drug Policy 1 (2022) (finding that medical cannabis laws did not reduce the rate of opioid overdoses between 2000-2005 and 2006-2011); Chelsea L. Shover, et al., Association between medical cannabis laws and opioid overdose mortality has reversed over time, 116 PNAS 12624 (2019) (finding that a medical cannabis law did reduce the number of opioid overdose deaths by 21.1% prior to 2010 but that the association flipped post 2010, with such laws then being related to a 22.7% increase in opioid overdose deaths); See also Chihuri, supra note 48 (finding that medical cannabis legalization was associated with a 8% reduction in opioid overdose mortality when combining the findings of 16 past studies); Bridget Freisthler, et al., Opioid Misuse and the Availability of Medical Marijuana Through Dispensaries, 81 J. Studies Alcohol Drugs 489 (2020) (finding that high densities of medical marijuana dispensaries in an area was associated with higher opioid misuse in the local area but lower levels of opioid misuse in adjacent areas); Julio Garin, et al., The Effect of Medical Cannabis Dispensaries on Opioid and Heroin Overdose Mortality, SSRN (2018), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3270101 (finding that counties saw a 8.2% reduction in opioid overdose deaths when a medical cannabis dispensary opens post-legalization).

50: Wen, supra note 41 at 991, 993-995.

51: Kim, supra note 49 at 3-5.

52: Morgan M. Philbin, et al., Medical cannabis laws and medical and non-medical prescription stimulant use among a nationally representative sample of US Adults: Examining the role of sexual identity and gender, 84 Int'l J. Drug Pol'y 1 (2020) (finding that medical cannabis laws were associated with a reduction in prescription stimulant use among heterosexual and bisexual individuals but no association for homosexual individuals); Yu-Wei Luke Chu, Do Medical Marijuana Laws Increase Hard-Drug Use?, 58 J. Law Econ. 481 (2015) (finding that medical marijuana legalization decreased both possession arrests and treatment admissions for heroin and cocaine); But see Yen-Han Lee, et al., Is Medical Marijuana Legalization Associated With Prescription Drug Misuse, Illicit Drug Use, or Combination of Both Among Adults in the United States?, 50 J. Drug Issues (2020) (finding that adoption of medical marijuana legalization is associated with the use of both prescription and illicit drugs); Wen, supra note 8 (2015) (finding that implementation of medical cannabis law is not associated with changes in non-medical use of pharmaceutical drugs or use of heroin and cocaine); See also Theodore Caputi & Keith Humphreys, Medical Marijuana Users are More Likely to Use Prescription Drugs Medically and Nonmedically, 12 J. Addiction Med. 295 (2018) (finding that medical marijuana users are more likely to have used prescription drugs for medical and non-medical uses in the past 12 months); Lisa Stolzenberg, et al., The effect of medical cannabis laws on juvenile cannabis use, 27 Int'l J. Drug Pol'y 82 (2016) (finding that adoption of medical cannabis laws in the first 16 states was associated with increased use of cannabis among 12-17 year olds); (finding that adoption of medical cannabis laws in the first 16 states was not associated with increased use of other drugs); Julio Garin, et al., The Effect of Medical Cannabis Dispensaries on Opioid and Heroin Overdose Mortality, SSRN (2018), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3270101 (finding counties saw a 10.5% reduction in heroin overdose deaths when a medical cannabis dispensary opens post-legalization).

