# ABSTRACT

Title of Thesis: FROM PROHIBITION TO LEGALIZATION: EXAMINING THE ASSOCIATION BETWEEN RECREATIONAL CANNABIS LEGALIZATION AND CHANGES IN DRUG SEIZURE RATES

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As recreational cannabis legalization continues to become a socially accepted policy throughout the United States, it is crucial to examine whether the policy is in line with the policymaker's intended outcomes or whether there are unintended consequences occurring as a result of the policy change. Some of the main reasons states have legalized recreational cannabis are to lower criminal justice expenditures, reduce crime, and decrease illicit market activity. To evaluate whether recreational legalization is effectively meeting these policy goals, this study looks into how recreational cannabis legalization is associated with changes in drug seizure rates. To examine the association, this paper aims to answer the following research questions by utilizing competing hypotheses: (1 What is the association between recreational cannabis legalization and cannabis seizure rates? (2 What is the association between recreational cannabis legalization and

heroin, methamphetamine, and oxycodone seizure rates? In doing so, this study will fill a gap in cannabis policy research by looking at recreational cannabis legalization as the explanatory factor that may cause a potential change in drug seizures. Using data from the National Forensic Laboratory Information System to conduct a longitudinal analysis, I estimate that recreational cannabis legalization will cause changes in drug seizure rates. The findings of this study show an association between recreational cannabis legalization and a decrease in cannabis and heroin. These outcomes are likely due to changes in police enforcement and an overall decrease or increase in hard drug use and trafficking.

# FROM PROHIBITION TO LEGALIZATION: EXAMINING THE ASSOCIATION BETWEEN RECREATIONAL CANNABIS LEGALIZATION AND CHANGES IN DRUG SEIZURE RATES

by

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# Introduction

During the War on Drugs in the 1970s, tough-on-crime drug policies that targeted several substances, including cannabis, were implemented throughout the United States. The implementation of the Controlled Substances Act (CSA) in 1970, which categorizes drugs based on their potential for abuse and medicinal value, led the federal government to categorize cannabis as a Schedule I substance, labeling it as a more dangerous and addictive drug than fentanyl ("Controlled Substance Act", n.d.). Under the CSA, Schedule I drugs have no accepted medical use in the United States and have a high potential for abuse ("Controlled Substance Act", n.d.). This shift in federal policy led to the enforcement of harsh penalties for the manufacturing, distribution, importation, exportation, and use of regulated substances, including cannabis (Ortiz & Preuss, 2024). Despite cannabis continuing to be illegal at the federal level in the 1970s due to the Marihuana Tax Act that passed in 1937, individual states slowly began to decriminalize it by reducing or eliminating penalties that targeted possession and use, making it a lesser offense than it was before (Pizzo, 2024). Growing research on cannabis led to a major shift in how the public viewed and stigmatized cannabis use, which influenced how states have approached cannabis policy (Bodie et al., 2022). In 2012, Washington state and Colorado became the first two states in the country to approve the legalization of recreational cannabis (Matthews & Hickey, 2023). By 2013, the residents of these states were able to consume recreational cannabis without the risk of a punishment, essentially putting an end to the War on Drugs in those two states. Over time, several states have followed in

their footsteps and have switched their approaches to cannabis policy. Today, 24 states and the District of Columbia have legalized cannabis for recreational use (Bryan, 2024). Because it is still a relatively new policy, it is crucial to understand both the intended and unintended outcomes of recreational cannabis legalization.

States that have legalized recreational cannabis have done so with aims of raising tax revenue, stimulating the economy, lowering criminal justice expenditures, reducing crime, and decreasing illicit market activity (Dills et al., 2021; Rogers, 2023). In order to evaluate whether recreational legalization is effectively meeting these policy goals, particularly whether illicit market activity has been decreasing, it is crucial to look at how legalization has impacted drug seizure rates. A drug seizure can be referred to as the confiscation of an illegal substance by law enforcement, often during a search or at a crime scene. Oftentimes, these seized drugs are taken by law enforcement to be used as evidence of a crime. In most states, depending on the laws, state, and drugs involved, these situations may also result in arrest. It is crucial to note that in many cases, when law enforcement finds drugs during a search or at a crime scene, it is very likely that there will be multiple drugs seized, meaning that one drug-related arrest does not necessarily indicate that there was one single drug seizure during that arrest, although there may be situations where that is the case.

While there is a good amount of research looking at how recreational cannabis legalization is associated with arrests, currently, there is only a small handful of cannabis policy research that looks at the association between recreational cannabis legalization and drug seizure rates. Almost all the existing research that studies this relationship uses drug seizure rates as a way to measure black market and law

enforcement activity. While some of these studies take factors such as street prices or drug potency into account, or use U.S Postal Inspection Service cannabis seizures instead of total national seizures as their outcome, prior research suggests that recreational cannabis legalization has led to a decrease in cannabis seizures, while other studies have also found that recreational legalization decreases oxycodone, hydrocodone, and heroin drug seizures (Meinhofer & Rubli, 2021; Worrall et al., 2022). Prior research on the relationship between recreational cannabis legalization and drug seizure rates use seizure rates to explain changes in black market or law enforcement activity after cannabis legalization (Montgomery et al., 2025; Worrall et al., 2022; Meinhofer & Rubli, 2021; Stohr et. al, 2020). These studies do not attribute the changes in drug seizure rates to the recreational legalization itself or use recreational legalization as the explanatory variable. This study will look at whether recreational legalization leads to changes in drug seizure rates by using legalization as the explanatory variable, instead of using seizure rates to reflect changes in black market and police enforcement activity to focus on the policy change itself.

This study aims to fill some gaps in existing cannabis policy research by answering the following questions: (1 What is the association between recreational cannabis legalization and cannabis seizure rates? (2 What is the association between recreational cannabis legalization and heroin, methamphetamine, and oxycodone seizure rates? Both questions will be studied using competing hypotheses. I will be using data from the National Forensic Laboratory Information System, Alcohol Policy Information System, and U.S. Census to answer these questions. By answering the first question, this study aims to add to current research that looks at how recreational

legalization impacts cannabis by using recreational legalization as the explanatory variable responsible for causing the potential change in cannabis seizures. By answering the second question, this study will contribute to the limited pool of research that examines whether recreational cannabis legalization is associated with and can be used to explain potential changes in hard drug seizure rates. Additionally, it provides a unique explanation for why hard drug seizure rates have potentially changed. By answering these questions, this paper aims to see whether changing the law for recreational cannabis is associated with changes (an increase or decrease) in cannabis, heroin, methamphetamine, and oxycodone seizure rates.

# Background

*Changes in Cannabis Seizure Rates*

There may be a relationship between recreational cannabis legalization and cannabis seizure rates. An increase in cannabis seizure rates following recreational cannabis legalization may be due to the thriving underground cannabis market. One of the main reasons why states tend to legalize the recreational use of cannabis is to fight the illicit market (Rogers, 2023). As more information regarding the impacts of recreational cannabis legalization and the success of the legal market has emerged, multiple states that have legalized recreational cannabis, including California, New York, and Maine, have started to notice that the legal cannabis industry is having trouble competing with the thriving underground market (Kaste, 2024). Considering the high taxation on cannabis and how difficult and expensive it is to enter the legal cannabis industry; more people may resort to selling and purchasing cannabis through the underground black market. In New York, retail sales from the legal market are dominated by illegal sellers (Kaste, 2024). As a result, Governor Kathy Hochul pledged to "crack down on illegal sellers" (Kaste, 2024). Maine, who is also struggling to fight the illegal cannabis producers that outnumber their legal market, has turned to the Department of Justice for help (Kaste, 2024). While these two states have not necessarily taken direct state-level action to combat the illicit market, California has. To use California as an example, in 2021, illegal cannabis sales in the state reached $8 billion, which is twice as much as the sales made from the legal market (Xing & Shi, 2024). As a result, Gavin Newsom, California's Governor, created the Unified Cannabis Enforcement Task Force, which teamed with California's Department of Justice to seize as much cannabis produced by the illicit market as possible (Harter,

2024). In 2024, Governor Newsome's team published a press release stating that both agencies seized approximately $534 million worth of illicit cannabis (n.a., 2025). This example, which shows how the government and law enforcement respond to unintended consequences of a law, demonstrates how a state, specifically one that has legalized recreational cannabis, responds to the thriving underground market and how that response could lead to an overall increase in cannabis seizures.

On the other hand, a decrease in cannabis seizure rates following recreational cannabis legalization may be due to a change in police enforcement. One of the main duties of being a law enforcement officer is to enforce the law and prevent crime. Because laws are constantly changing to match societal changes, court decisions, and legal/legislative changes, it is crucial for law enforcement to stay informed on changes in the law in order to effectively enforce them (Bucco, 2024). Law enforcement are responsible for respecting, enforcing, and adapting to the laws regardless of whether they agree or disagree with them. In terms of recreational cannabis legalization, law enforcement is required to adhere to their state's specific cannabis regulations. A shift in cannabis regulation can lead to a shift in policing priorities. While recreational cannabis laws vary by state, because individuals are legally allowed to consume and possess cannabis recreationally, law enforcement will change their approach and will not be arresting or seizing as many individuals for the consumption or possession of the substance. Research from Washington state has found that since recreational legalization in the state, there has been a de-prioritization of cannabis related offenses by both police and prosecutors (Stohr et al., 2020). Additionally, in the first years of recreational legalization in Washington state, "seizures of contraband marijuana in

traffic stops decreased between 2012 and 2014 by almost 62%" (Stohr et al., 2020). Because cannabis is no longer a criminal offense in the states that have legalized it for recreational use, except if found in large quantities or if it seems that there is intent to traffick, (legal amount a person can have of cannabis and requirements for legal distribution vary per state), law enforcement are no longer required to search, arrest, or seize cannabis from individuals that are adhering to the law. After legalization, the same activity that once led to a search, arrest, or seizure for cannabis does not necessarily apply. Although arrests differ from seizures, states that have legalized recreational cannabis have noticed a decrease in the number of individuals taken into the justice system for cannabis possession (Stohr et al., 2020). While decriminalization, which is the act of removing criminal sanctions against an act, article, or behavior, including the possession of drugs while they remain prohibited differs from legalization, which removes all legal prohibitions against a substance, other studies find that the decriminalization of cannabis was associated with large reductions in cannabis arrests for adults and youth (Svrakic et. al, 2012; Gunadi and Shi, 2024). Considering that people are often brought into the justice system due to their initial contact with law enforcement, a change in law allowing recreational cannabis use and possession may result in law enforcement not seizing cannabis at the rate that they were when it was illegal, which could result in an overall decrease in seizure.

*Changes in Hard Drug Seizures*

There may be a relationship between recreational cannabis legalization and hard drug seizure rates. An increase in hard drug seizure rates following recreational

cannabis legalization may be due to increased hard drug use and increased hard drug trafficking. A potential explanation for an increase in hard drug use after recreational cannabis legalization is the gateway drug hypothesis. The gateway drug hypothesis refers to the idea that using milder substances, in this case cannabis, can potentially lead people to experiment with harder substances, such as heroin, methamphetamine, and oxycodone (Noel & Wang, 2018). While there is contradicting evidence on whether cannabis can be a gateway substance, a lifetime cumulative estimate study found that 44.7% of individuals with lifetime cannabis use progressed to illicit drug use at some point in their lives (Secades-Villa et al., 2016; Marshall, 2023; Morrall et al., 2022). The same study, which is in line with previous research, also found that the cumulative probability of other illicit drug initiation a decade after the initial cannabis use was 36%. If cannabis is considered to be a gateway drug, having easier access to recreational cannabis because of legalization could possibly lead people to start experimenting cannabis, which could eventually lead them to want to experiment with harder substances such as heroin, oxycodone, and methamphetamine (Perez et al., 2023; Mayet et al., 2016). An increase in demand in hard drugs after legalization may lead to an overall increase in hard drug trafficking, which may result in an increase in seizure rates. While this study does not look at the relationship between cannabis use and harder drug use, if there is a relationship between the two, then it is possible that people are arrested for hard drugs at higher rates when cannabis is legalized compared to when cannabis is prohibited, which would ultimately result in an increase in hard drug seizures.

Another possibility that could lead to increased heroin, methamphetamine, and oxycodone drug seizure rates could be an overall increase in drug trafficking. Legalizing recreational cannabis could potentially shift the priorities and resources allocated towards law enforcement, which can possibly have an effect on the drug trafficking of hard drug substances. As mentioned earlier, increased drug trafficking may be the result of an increase in drug demand and may result in an increase in seizures. Regarding heroin, "increased demand for, and use of, heroin is being driven by both increasing availability of heroin in the U.S. market and by some controlled prescription drug (CPD) abusers using heroin" (n.a., 2016). The increase in heroin demand is likely due to the major decreases in heroin prices, allowing people to purchase the drug for cheaper (n.a., 2016). An increase in heroin demand post legalization may lead to an increase in heroin trafficking, which could ultimately lead to an increase in heroin seizure rates. Because methamphetamine has always been less expensive and more easily available than other drugs, its drug trafficking rates have significantly increased over the years (NDIC, 2005). If the gateway effect for cannabis is true, then the rates of methamphetamine use post legalization may increase, which may increase demand, and could lead to an increase in methamphetamine seizures. Because oxycodone is a highly regulated drug, people are willing to turn to the illicit market to obtain it (Preuss et al., 2023). If more people are turning to the illicit market to purchase drugs such as oxycodone after recreational cannabis legalization, there may be an increase in oxycodone seizures.

On the other hand, a decrease in hard drug seizure rates following recreational cannabis legalization may be due to an overall decrease in hard drug use. The

legalization of cannabis could result in the substitution effect, which refers to the idea that legalizing recreational cannabis can be a substitute for other illicit substances, which for the purpose of this study, would be heroin, methamphetamine, and oxycodone (Liu et al., 2024). Going off this theory, because recreational cannabis will be a safer and more accessible alternative, people that are illegally using drugs such as heroin, oxycodone, and methamphetamine may stop using these drugs and will switch to cannabis, as it is a safer and legal option. This may result in a decrease of hard drug usage and will essentially result in less hard drug seizures. Prior research has found that in states where cannabis is legalized, there has been an overall increase in cannabis consumption (Marshall, 2022; Marples, 2022). The same research also found that residents that live in states where cannabis has been legalized use cannabis 24% more frequently than those living in states where it is still prohibited (Marshall, 2022). Additionally, there has been a significant reduction in synthetic opioid deaths associated with recreational cannabis laws, which may be an indicator of decreased hard drug use (Nguyen et al., 2024). Ultimately, the less that people are using these hard drugs, the fewer seizures there will be. Similarly to the reasoning for an increase in hard drug seizures, if fewer people are not using hard drugs, there will be less of a demand for them, which could potentially result in an overall decrease in heroin, methamphetamine, and oxycodone trafficking. An overall decrease in trafficking could potentially result in an overall decrease in hard drug seizure rates.

## Current Study

In examining the association of recreational cannabis legalization with cannabis and hard drug seizure rates, this study will fill a gap in cannabis policy research that will determine whether changing the law around recreational cannabis will have an impact on the seizures of cannabis, heroin, oxycodone, and methamphetamine. Changing the law for recreational cannabis legalization may lead to changes in cannabis, heroin, methamphetamine, and oxycodone seizure rates. While there is various existing research on the relationship between cannabis legalization and cannabis arrest rates and crime rates, there are a limited number of studies that look at the impact legalization has on drug seizures. Using drug seizures rates instead of arrest rates as the measure can give us information that arrest rates may not be able to give us. Seeing whether there are changes in drug seizure rates can inform us on how active drug markets are in a given state- year not only in the United States, but around the world as well (Finklea, 2019). Seeing whether there has been an increase in the seizures of a specific drug, whether that be cannabis, heroin, methamphetamine, or oxycodone may be an indicator that the illicit market for that drug is active, which can inform researchers to look into what parts of the world these illicit drugs are coming from. Knowing this information can allow policymakers to take action by finding ways to stop the flow of these drugs into the United States. Additionally, looking into the effects that cannabis legalization has on seizure rates for cannabis, oxycodone, heroin, and methamphetamine can allow policymakers to see whether more or less money, resources, and law enforcement personnel should be allocated towards drug seizing efforts, depending on if there happens to be a change in seizures. Fewer drug

seizures can allow the criminal justice system to make the decision to allocate their time and money towards other criminal justice concerns and can be an indicator that police are adapting to cannabis law properly, while an increase in seizures may indicate that illegal cannabis markets are growing, which can be a signal for states to find other solutions to combat the illicit market and incentivize governments to increase these resources to crack down on the illicit drug.

# Data & Methods

*Data*

This study uses state-level data from three publicly available data sources. Information for total drug seizures in a state was found through the National Forensic Laboratory Information System (NFLIS) for 2010-2022. The NFLIS, a program of the Drug Enforcement Administration's Diversion Control Division, contains public information from several drug seizure cases found at both the federal and state levels. These files contain information on drug seizures in all 50 states and the District of Columbia (D.C.). There are separate datasets for each year that contain the total number of drug seizures for several kinds of drugs, including cannabis, heroin, oxycodone, and methamphetamine. The NFLIS drug seizure data is collected by federal, state, and local forensic laboratories. Once a drug is seized, the substance is tested and recorded. Depending on the circumstances, once the drug has been examined by the labs, the drug is either disposed of or kept as evidence, and the data is recorded and sent to the DEA to be added to the NFLIS (Ali, 2024). To capture the status of cannabis legalization for every state from 2010-2022, I will be using the Alcohol Policy Information System (APIS). This public source contains the status of cannabis laws at the state level over the span of 13 years (2010-2022). Finally, I have also gathered state-level data from the U.S. Census Bureau's American Community Survey 5-Year Estimates to use as control variables. For this study, I have gathered several state demographics including race, ethnicity, sex, age, and educational attainment. It is important to control for these variables, as they could potentially confound the relationship between recreational cannabis legalization and drug seizure rates.

I will be conducting a longitudinal analysis, as I will be examining the changes in state seizure rates per 100,000 each year from 2010 to 2022. Recreational cannabis was not legalized in a state until 2012, but I wanted to include data from two years prior to legalization to see if there are any changes from when cannabis was not legal for recreational use at all to when 20+ states have legalized it 13 years later. The unit of analysis for this study is state-year. Since I will be looking at seizure rates in the 50 states + D.C. for every year from 2010-2022, I will have a total of 663 state-year observations ((50 states + D.C.) x 13 years = 663).

## *Measures*

### *Outcome Variable*

The outcome variable is measured as state drug seizure rates (per 100,000). Drug seizure data is found in the NFLIS. The NFLIS data lists out all the drugs that have been seized in the past year around the country and lists the total amount of seizures of a drug for each state + D.C. from 2010-2022. I have collected the drug seizure data for cannabis, heroin, oxycodone, and methamphetamine using the NFLIS data source for those 13 years.

### *Explanatory Variable*

The explanatory variable is measured as the legalization status of cannabis in a state (legalized or prohibited). This data is found in the APIS. This binary variable serves as the main factor for looking at whether there does happen to be an association with drug seizure rates.

### *Control Variables*

I will be controlling for several variables to avoid having exogenous variables impact the relationship between the outcome and explanatory variable. This study is controlling for the racial, ethnic, sex, and age composition of a state in a given year. State racial composition is crucial to control for, as it is an effective way to fish out any uncertainties around whether the seizure rates are the outcome of the cannabis legalization policy and not racial disparities, considering people of color tend to be stopped more often for drug possession than others (Rosenberg et. al, 2016). Sex composition is important to control because men tend to have higher rates of use and dependence on drugs, which could cause states that have a slightly higher male population to have higher seizure rates (NIDA, 2020). The age composition should be controlled for due to the large difference in drug possession and use amongst age groups (Leal & Mier, 2015). Average educational attainment is also important because individuals with lower levels of education tend to have different drug use patterns than those with higher education (Fothergill et. al, 2008). In addition to these, I control for state to make sure that I am accounting for anything about the state that does not change over time, as well as year, in order to account for the trends in seizures that happen over time.

*Methods*

As mentioned earlier, this study analyzes the relationship between recreational cannabis legalization/prohibition and its association with drug seizure rates by conducting a longitudinal study. In order to construct my dataset to examine this association, I first gathered the information that I needed from the NFLIS, APIS, and U.S. Census Bureau. I then organized this information in an Excel sheet with the states

in rows and the drug seizure and demographic control variable data in the columns. Once I had the total population of the state within each demographic category, I turned my variables into percentages by dividing the total number for each category by the total state population and then multiplied that value by 100. Next, I calculated the seizure rates. To get the drug seizure rates of each state and year per every 100,000 people, I divided the number of seizures in a given state and year by the population of the state in that year and multiplied by 100,000. I repeated this process for each drug. Once I had identified the status of recreational cannabis in a state using the APIS data, I created a binary variable. For this study, a 1 indicates that recreational cannabis was legalized in that state/year, and a 0 indicates that cannabis was still prohibited. Once my dataset was constructed, I used Stata to run descriptive statistics (Table 1 and Table 2).

In order to see the association between recreational cannabis legalization and drug seizure rates, I used a series of linear regression models to predict the seizure rate of each individual drug. The outcome of the regression models conducted in this study will be the drug seizure rates per state and year. I estimated bivariate models that included only legalization as the explanatory variable. I compared these to two multivariable models, one that included only state and year, and another that included all of my control variables, as well as state and year. For certain demographic characteristics, I left out some reference categories (noted in the regression models), to use as points of comparison.

## Descriptive Statistics

*Descriptive Statistics 2010*

Table 1 (which can be accessed in the appendix down below) presents the mean, standard deviation (SD), and range (min and max) for the explanatory, outcome, and control variables for the year 2010. In 2010, the mean, SD, and range for legal status, the explanatory variable, was 0, as no states had legalized cannabis in that year. Out of the drug seizure rates for 2010, cannabis had the highest average seizure rate at 186.67 seizures per 100,000 people. Cannabis also had the highest number of seizures out of the four drugs in 2010 with a maximum of 631.196 seizures. In terms of demographics, white alone was the highest mean out of any other race category while Native Hawaiian was the lowest. The sex composition variable was pretty even with females having a slightly larger average than males across states. The age category with the largest number of individuals was the 35-54 group while the lowest was the 10-14 group. Average educational attainment was very split in terms of averages for high school graduates (and equivalency), some college/associate's degree, and bachelor's degree or higher.

*Descriptive Statistics 2022*

Table 2 (which can be accessed in the appendix down below) presents the mean, standard deviation (SD), and range (min and max) for the explanatory, outcome, and control variables for the year 2022. In 2022, the mean number changes to 0.392, indicating that 20 states had legalized recreational cannabis by the end of the year (51*0.392). Out of the drug seizure rates for 2022, methamphetamine had a significantly higher average seizure rate than cannabis at 116.98 seizures per 100,000 people. This

shows that while cannabis seizure rates have been on the decline, methamphetamine seizure rates have been increasing, as the meth seizure rates about doubled in size. This trend can also be observed in Figure 1. In terms of demographics, white alone continued to have the highest mean out of any other race category while Native Hawaiian was still the lowest. The percentage of males and females in 2022 remains close. Though it slightly decreased, the age category with the largest number of individuals continued being the 35-54 group while the lowest continued being the 10-14 group. In 2022, educational attainment was less split, considering that individuals falling under the bachelor's degree or higher had the largest mean.

*Drug Seizure Rate Line Graph*

Figure 1 shows a line graph that demonstrates the changes in drug seizure rates (per 100,000) for cannabis, methamphetamine, oxycodone, and heroin from 2010 to 2022. The Y axis shows the seizure rates and the X axis has all the state years. Overall, while there are some spikes in seizures during some years, the seizure rates of all four drugs have been on the decline. When you observe the trend for cannabis seizures, there was a significant increase in seizures from 2010-2011. From 2012 through to 2015, seizures significantly declined until they increased again from 2015 to 2016. Since 2016, cannabis seizures rates have been declining, which could potentially be due to changes in cannabis policy. For methamphetamine, the seizure rates increased from 2012 through to 2020, where there was then a small decline in seizures. Since 2022, there's been a decline in methamphetamine seizures. For heroin, there was a spike in seizure rates in 2014. Ever since that spike, the seizure rates have been on a steady decline. Similarly to heroin, oxycodone experienced a slight increase in seizures in 2011 but has been steadily

decreasing up until 2022. Overall, this data shows that seizures for all four drugs have been declining.

# Regression Model Outcomes

*Recreational Cannabis Legalization and Cannabis Seizures*

Table 3 presents results of my regression models of the change in cannabis seizure rates associated with recreational legalization. Model 1 shows the bivariate association, indicating that legalization is associated with a decline of 107 cannabis seizures per 100,000 people ($p < 0.001$). This finding shows that in the years when a state has legalized cannabis, they are expected to have 107 less seizures per 100,000 people than they have in the years before that state legalized cannabis. Model 2 shows the association while controlling for state and year, indicating that legalization is associated with 30 fewer cannabis seizures per 100,000 people ($p < 0.05$). This finding shows that in the years when a state has legalized cannabis, they are expected to have 30 fewer seizures per 100,000 people than they have in the years before that state legalized cannabis. Model 3 shows the multivariate association with all added controls, indicating that legalization is associated with a decline of 32 seizures per 100,000 people ($p < 0.05$). This finding shows that after adding control variables, in the years when a state has legalized cannabis, they are expected to have 32 fewer cannabis seizures per 100,000 people than they have in the years before that state legalized cannabis.

*Recreational Cannabis Legalization and Hard Drug Seizures*

Table 4 presents results of my regression models of the change in heroin seizure rates associated with recreational legalization. Model 1 shows the bivariate association, indicating that legalization is associated with a decline of 3 heroin seizures per 100,000 people. It is important to note that the results show no evidence for a significant

association between legalization and heroin seizures. Model 2 shows the association while controlling for state and year, indicating that legalization is associated with 16 fewer seizures per 100,000 people ($p < 0.001$). This finding shows that in the years when a state has legalized cannabis, they are expected to have 16 fewer heroin seizures per 100,000 people than they had in the years before that state legalized cannabis. Model 3 shows the multivariate association with all added control variables, indicating that legalization is associated with a decline of 9 seizures per 100,000 people ($p < 0.05$). This finding shows that after adding control variables, in the years when a state has legalized cannabis, they are expected to have 9 fewer heroin seizures per 100,000 people than they have in the years before that state legalized cannabis.

Table 5 presents results of my regression models of the change in methamphetamine seizure rates associated with recreational legalization. Model 1 shows the bivariate association, indicating that legalization is associated with a decline of 35 methamphetamine seizures per 100,000 people ($p < 0.01$). This finding shows that in the years when a state has legalized cannabis, they are expected to have 35 fewer methamphetamine seizures per 100,000 people than they have in the years before that state legalized cannabis. Model 2 shows the association while controlling for state and year, indicating that legalization is still associated with 35 fewer methamphetamine seizures per 100,000 people ($p < 0.001$). This finding shows that in the years when a state has legalized cannabis, they are expected to have 35 fewer seizures per 100,000 people than they had in the years before that state legalized cannabis. Model 3 shows the multivariate association with all added control variables, indicating that legalization is associated with a decrease of 10 seizures per 100,000 people. This finding shows that

after adding control variables, in the years when a state has legalized cannabis, they are expected to have 10 fewer methamphetamine seizures per 100,000 people than they have in the years before that state legalized cannabis. The results show no evidence for a significant association between legalization and methamphetamine seizures.

Table 6 presents results of my regression models of the change in oxycodone seizure rates associated with recreational legalization. Model 1 shows the bivariate association, indicating that legalization is associated with a decline of 10 oxycodone seizures per 100,000 people ($p < 0.001$). This finding shows that in the years when a state has legalized cannabis, they are expected to have 10 fewer oxycodone seizures per 100,000 people than they have in the years before that state legalized cannabis. Model 2 shows the association while controlling for state and year, indicating that legalization is associated with 3 fewer seizures per 100,000 people ($p < 0.05$). This finding shows that in the years when a state has legalized cannabis, they are expected to have 3 fewer oxycodone seizures per 100,000 people than they had in the years before that state legalized cannabis. Model 3 shows the multivariate association with all added control variables, indicating that legalization is associated with a decline of 0.786 seizures per 100,000 people. This finding shows that after adding control variables, in the years when a state has legalized cannabis, they are expected to have 0.786 fewer oxycodone seizures per 100,000 people than they had in the years before that state legalized cannabis. The results show no evidence for a significant association between legalization and oxycodone seizures.

# Discussion

*Discussion*

Even while being a relatively new policy, since its legalization in 2012, the increased social acceptance of recreational cannabis has led to several changes, particularly in the rates at which drugs are being seized. The purpose of this study has been to examine whether recreational cannabis legalization is associated with increases or decreases in the seizures of cannabis, heroin, methamphetamine, and oxycodone. This was done by conducting a longitudinal state-year analysis from 2010 through to 2022. Due to limited research on this relationship, the goal of this paper has been to provide a unique perspective on previous research that studies change in drug seizures after the legalization of recreational cannabis. While prior studies use drug seizure rates to measure black market and law enforcement activity, this research aims to fill a gap in current cannabis policy research that does not use recreational cannabis legalization as the explanation for why there may be a change in drug seizure rates.

The results of the first regression model suggest that recreational cannabis legalization is associated with an overall decrease in cannabis seizure rates. This outcome supports the competing hypothesis that recreational cannabis legalization is associated with an overall decrease in seizures, which may be due to changes in police enforcement. Law enforcement are responsible for respecting, enforcing, and adapting to the law regardless of whether they agree or disagree with them. As mentioned earlier, even if the recreational use of cannabis is a law that officers may not agree with, they are still required to follow their state's specific cannabis policies. A decrease in cannabis seizures can be a possible indicator that there has been a change

in law enforcement, showing that they are adhering to the law and are no longer stopping, arresting, and seizing cannabis from people at the rates that they were when cannabis was prohibited, as the same actions revolving cannabis that were once illegal are no longer punishable (except in certain circumstances). Prior research shows that states that have legalized recreational cannabis have noticed an overall decrease in the number of individuals being taken into the justice system for cannabis possession, which also shows that the change in law has led to a shift in law enforcement, which would also result in a decrease in cannabis seizures (Stohr et. al, 2020). A decrease in cannabis seizures due to a change in law enforcement goes to show that recreational cannabis legalization tends to lead to the de-prioritization of cannabis related offenses, which was discussed in prior research (Stohr et al., 2020). While a prior study took things such as street prices, potency, and quality into account when determining if law enforcement seizures changed, the findings of this study is consistent with findings from a Cornell study that found a 93% decrease in law enforcement seizures of illegal cannabis in states that implemented recreational cannabis legalization (Meinhofer & Rubli, 2021).

The results of the second regression model suggest that recreational cannabis legalization is associated with an overall decrease in heroin seizure rates. This outcome supports the competing hypothesis that recreational cannabis legalization is associated with an overall decrease in heroin, which may be due to the substitution effect and a decrease in heroin use and trafficking. This finding is consistent with prior research that found that states that had implemented recreational cannabis legalization had a greater than 50% decrease in law enforcement seizures of heroin (Meinhofer &

Rubli, 2021). A decrease in heroin seizure rates suggests that the substitution effect, which refers to the idea that legalizing recreational cannabis be a substitute for other illicit substances, because of recreational cannabis legalization, may have come into play (Liu et al., 2024). This outcome may be an indicator that there has been an overall decrease in heroin use, possibly due to the legality and accessibility of cannabis after legalization. While a decrease in heroin use can be linked to several factors, prior research that examines changes in drug pricing in the dark market, found a 64% increase in heroin prices (Meinhofer & Rubli, 2021). Based on that, an increase in heroin prices over the years may potentially be leading people to find a cheaper, legal, and/or more accessible alternative, such as legal cannabis, which could be a factor that has led to an overall drop in heroin use and seizures.

Because there was no statistical significance in the results of the third regression model, the change in methamphetamine seizures shown may not necessarily be directly caused by or associated with recreational cannabis legalization. This result was not expected, considering that prior research suggests that methamphetamine seizure rates have been increasing over time (United Nations Office on Drugs and Crime, 2021; Bebinger, 2019).

Because there was no statistical significance in the results of the fourth regression model, the change in oxycodone seizures shown on the regression model may not necessarily be directly caused by or associated with recreational cannabis legalization. This result was not expected, considering that prior research has found an overall decrease in oxycodone seizures (Meinhofer & Rubli, 2021).

*Limitations*

While this study has provided several insights regarding recreational cannabis legalization and drug seizure rates, it is crucial to acknowledge its limitations. It is crucial to highlight that this study does not control for the legalization of medical cannabis. Not controlling for medical legalization could potentially skew the results and the rates at which drug seizures have changed. While a state may not necessarily permit recreational legalization, it is possible that they allow medicinal cannabis use, which could have an impact on number drug seizures in that particular state/year. Additionally, states that legally allow both medicinal and recreational cannabis could see a shift in the number of seizures. Another important limitation is that I was unable to account for the variation in recreational legalization policies. Policies for recreational cannabis such as the amount a person can legally possess varies from state to state and for this study, I was unable to account for those differences. Finally, the results of this study are based on observational data, meaning that other variables that were not observed could potentially confound the relationship between recreational cannabis legalization and seizures.

# Conclusion & Policy Implications

Given that recreational cannabis legalization is still a relatively new policy change, this study adds to existing cannabis policy research that examines the association between legalization and drug seizures. This study finds an association between recreational cannabis legalization and changes in drug seizure rates. More specifically, recreational cannabis legalization is associated with a decrease in cannabis and heroin seizures but has no association with methamphetamine and oxycodone seizures due to the lack of statistical significance. It is important to understand the changes that recreational cannabis legalization can have on drug seizures, as it can be a way of evaluating whether recreational legalization is causing any unintended concerns, such as spikes in the illicit industry. While prior literature studies drug seizure rates by examining black market activity and law enforcement responses after recreational cannabis has been legalized, this study examines legalization itself as the primary factor behind those drug seizure changes. This approach shifts the focus to the direct impact of the policy change, which can give us an idea of the policy's societal impact and outcomes. The results of this study could potentially be beneficial for future policy implications. Understanding the changes in drug seizure rates post-recreational legalization can give states information that could allow them to see whether more or less money, resources, and law enforcement personnel should be allocated towards drug seizures. A decrease in seizures can allow states to reallocate their funds towards other concerns while an increase in seizures may require states to allocate more resources to drug seizure efforts. Additionally, having information on seizure rates can allow us to see how active the illicit market is

and can give us an idea as to what areas of the world the drugs are coming from. Seeing whether recreational legalization has had an impact on the illicit drug market can allow states to find an appropriate response to address the concern. From a public health perspective, having access to safe, tested, and legal cannabis may lead to people to reduce their use of harsher substances. These implications could also be incentives for other states or the federal government to legalize recreational cannabis use. Future research should build on these findings by controlling for medical cannabis legalization to determine how that could potentially impact the drug seizure rates. Additionally, future studies could examine the seizure rates of other hard drugs that were not included in this study, and should reexamine the association between recreational cannabis legalization and methamphetamine and oxycodone seizure rates.

# Appendices

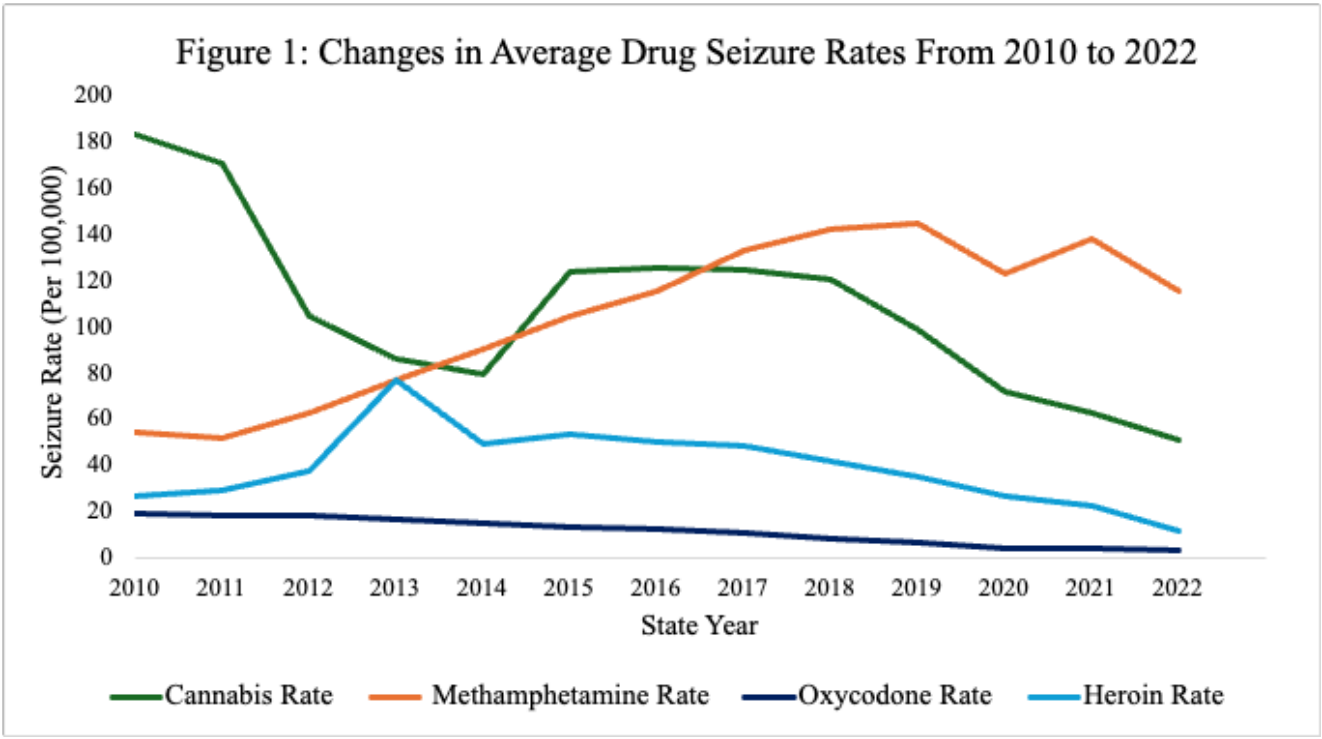
Figure 1: Changes in Average Drug Seizure Rates From 2010 to 2022
Seizure Rate (Per 100,000)
200
180
160
140
120
100
80
60
40
20
0
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
State Year
Cannabis Rate
Methamphetamine Rate
Oxycodone Rate
Heroin Rate

**Table 1. Descriptive Statistics for Full Sample in 2010**

| | Mean | SD | Min | Max |
|---|---|---|---|---|
| **Outcome Variables** | | | | |
| Heroin Seizure Rates (per 100,000) | 27.226 | 35.252 | 0.250 | 169.527 |
| Meth Seizure Rates (per 100,000) | 55.669 | 61.139 | 0.947 | 289.960 |
| Oxycodone Seizure Rates (per 100,000) | 19.872 | 21.838 | 0.663 | 126.953 |
| Cannabis Seizure Rates (per 100,000) | 186.662 | 165.544 | 0.568 | 631.196 |
| **Explanatory Variable** | | | | |
| Cannabis legal status | 0.000 | 0.000 | 0.000 | 0.000 |
| **Control Variables** | | | | |
| **Race (Percentage)** | | | | |
| White Alone | 77.372 | 13.842 | 25.033 | 95.625 |
| Black or African American Alone | 11.057 | 11.190 | 0.444 | 52.883 |
| American Indian and Alaska Native Alone | 1.583 | 2.808 | 0.144 | 14.196 |
| Asian Alone | 3.624 | 5.629 | 0.624 | 39.431 |
| Native Hawaiian and Other Pacific Islander Alone | 0.306 | 1.339 | 0.014 | 9.573 |
| Some Other Race Alone | 3.336 | 3.158 | 0.225 | 14.872 |
| **Ethnicity (Percentage)** | | | | |
| Hispanic or Latino (Any Race) | 10.110 | 9.691 | 1.138 | 45.397 |
| Not Hispanic or Latino | 89.890 | 9.691 | 54.603 | 98.862 |
| **Sex (Percentage)** | | | | |
| Male | 49.294 | 0.855 | 47.000 | 52.000 |
| Female | 50.706 | 0.855 | 48.000 | 53.000 |
| **Age (Percentage)** | | | | |
| 0-9 | 13.103 | 1.360 | 10.014 | 18.436 |
| 10 to 14 | 6.681 | 0.499 | 4.564 | 8.153 |
| 15 to 19 | 7.260 | 0.320 | 6.459 | 8.171 |
| 20 to 34 | 20.124 | 1.812 | 16.862 | 29.071 |
| 35 to 54 | 28.271 | 1.372 | 23.351 | 31.539 |
| 55 to 64 | 11.608 | 0.892 | 8.342 | 13.612 |
| 65 and above | 12.954 | 1.669 | 7.256 | 16.930 |
| **Educational Attainment (Population 25+)** | | | | |
| Less than High School Graduation | 8.292 | 2.102 | 5.020 | 12.374 |
| High School Graduate (includes equivalency) | 19.440 | 2.935 | 13.392 | 28.687 |
| Some College, associate's degree | 19.750 | 2.591 | 11.902 | 25.588 |
| Bachelor's Degree or Higher | 18.773 | 4.105 | 12.281 | 35.453 |
| **N =** | **51** | | | |

Notes: SD= Standard Deviation, Min = Minimum, Max = Maximum

## Table 2. Descriptive Statistics for Full Sample in 2022

| | Mean | SD | Min | Max |
|---|---|---|---|---|
| **Outcome Variables** | | | | |
| Heroin Seizure Rates (per 100,000) | 12.399 | 11.399 | 0.805 | 52.034 |
| Meth Seizure Rates (per 100,000) | 116.980 | 100.530 | 1.640 | 386.296 |
| Oxycodone Seizure Rates (per 100,000) | 3.926 | 3.355 | 0.000 | 13.971 |
| Cannabis Seizure Rates (per 100,000) | 54.208 | 81.121 | 0.000 | 371.326 |
| **Explanatory Variable** | | | | |
| Cannabis legal status | 0.392 | 0.493 | 0.000 | 1.000 |
| **Control Variables** | | | | |
| **Race (Percentage)** | | | | |
| White Alone | 71.063 | 14.185 | 22.977 | 92.283 |
| Black or African American Alone | 11.103 | 10.415 | 0.552 | 44.305 |
| American Indian and Alaska Native Alone | 1.530 | 2.780 | 0.096 | 14.283 |
| Asian Alone | 4.373 | 5.471 | 0.759 | 37.155 |
| Native Hawaiian and Other Pacific Islander Alone | 0.362 | 1.458 | 0.019 | 10.396 |
| Some Other Race Alone | 4.004 | 3.189 | 0.530 | 16.234 |
| **Ethnicity (Percentage)** | | | | |
| Hispanic or Latino (Any Race) | 12.495 | 10.404 | 1.836 | 49.782 |
| Not Hispanic or Latino | 87.505 | 10.404 | 50.218 | 98.165 |
| **Sex (Percentage)** | | | | |
| Male | 49.725 | 0.874 | 48.000 | 53.000 |
| Female | 50.275 | 0.874 | 47.000 | 52.000 |
| **Age (Percentage)** | | | | |
| 0-9 | 11.759 | 1.117 | 9.364 | 15.262 |
| 10 to 14 | 6.412 | 0.582 | 4.817 | 8.273 |
| 15 to 19 | 6.592 | 0.521 | 4.814 | 8.208 |
| 20 to 34 | 20.332 | 1.703 | 17.661 | 29.466 |
| 35 to 54 | 24.911 | 0.932 | 22.765 | 26.971 |
| 55 to 64 | 13.030 | 1.122 | 9.336 | 15.701 |
| 65 and above | 16.963 | 2.017 | 22.765 | 21.470 |
| **Educational Attainment (Population 25+)** | | | | |
| Less than High School Graduation | 6.150 | 1.629 | 3.643 | 10.394 |
| High School Graduate (includes equivalency) | 18.250 | 2.889 | 10.509 | 27.191 |
| Some College, associate's degree | 19.828 | 2.441 | 10.744 | 24.660 |
| Bachelor's Degree or Higher | 23.140 | 5.048 | 15.781 | 45.149 |
| **N =** | **51** | | | |

Notes: SD= Standard Deviation, Min = Minimum, Max = Maximum

**Table 3: Linear Regression Results- Cannabis Seizure Rate Regressed on Recreational Cannabis Legalization Status**

| Variables | Model 1 Bivariate | Model 2 + State, Year | Model 3 + Controls |
|---|---|---|---|
| **Explanatory Variable** | | | |
| Legalization Status | -107.013 (14.440) *** | -30.196 (13.070) * | -32.750 (15.639) * |
| **Covariates** | No | No | Yes |
| **Race (Percentage)** | | | |
| White (Alone) | | | -2.064 (4.582) |
| Black or African American Alone | | | -0.047 (12.348) |
| American Indian and Alaska Native Alone | | | 104.711 (40.916) * |
| Asian Alone | | | -11.476 (18.960) |
| Native Hawaiian and Other Pacific Islander Alone | | | --- |
| Some Other Race Alone | | | -2.714 (9.391) |
| **Ethnicity (Percentage)** | | | |
| Not Hispanic or Latino | | | --- |
| Hispanic or Latino (Any Race) | | | 6.200 (10.638) |
| **Sex (Percentage)** | | | |
| Male | | | 167.112 (60.157) ** |
| Female | | | --- |
| **Age (Percentage)** | | | |
| 0-9 | | | -80.976 (22.122) *** |
| 10-14 | | | -17.072 (42.571) |
| 15-19 | | | 23.734 (41.934) |
| 20-34 | | | -18.459 (21.322) |
| 35-54 | | | -31.805 (14.828) * |
| 55-64 | | | -51.961 (19.812) * |
| 65 and above | | | --- |
| **Educational Attainment (Population age 25+)** | | | |
| Less than High School Graduation | | | -27.330 (21.018) |
| High School Graduate (includes equivalency) | | | -23.279 (16.390) |
| Some College, associate's degree | | | -21.507 (17.509) |
| Bachelor's Degree or Higher | | | -4.278 (14.670) |
| Controls for State | No | Yes | Yes |
| Controls for Year | No | Yes | Yes |
| Constant | 126.926 (5.608) *** | 279.389 (24.636) *** | -3576.801 (2959.909) |

Notes: Standard Error is reported in parentheses. N=663 in all models. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$ (two-tailed). The following controls were used as reference categories: Native Hawaiian and Other Pacific Islander Alone, Not Hispanic or Latino, and 65 and above. Data is from the years 2010 through to 2022.

**Table 4: Linear Regression Results- Heroin Seizure Rate Regressed on Recreational Cannabis Legalization Status**

| Variables | Model 1 Bivariate | Model 2 + State, Year | Model 3 + Controls |
|---|---|---|---|
| **Explanatory Variable** | | | |
| Legalization Status | -3.984 (4.510) | -16.816 (3.880) *** | -9.221(4.462) * |
| **Covariates** | No | No | Yes |
| **Race (Percentage)** | | | |
| White (Alone) | | | -1.566 (1.307) |
| Black or African American Alone | | | -6.240 (3.523) |
| American Indian and Alaska Native Alone | | | -15.847 (11.673) |
| Asian Alone | | | -6.474 (5.409) |
| Native Hawaiian and Other Pacific Islander Alone | | | --- |
| Some Other Race Alone | | | -0.493(2.679) |
| **Ethnicity (Percentage)** | | | |
| Not Hispanic or Latino | | | --- |
| Hispanic or Latino (Any Race) | | | -8.751 (3.035) * |
| **Sex (Percentage)** | | | |
| Male | | | -12.557 (17.162) |
| Female | | | --- |
| **Age (Percentage)** | | | |
| 0-9 | | | 6.979 (6.311) |
| 10-14 | | | 43.489 (12.145) *** |
| 15-19 | | | 40.789 (11.963) ** |
| 20-34 | | | 14.122 (6.083) * |
| 35-54 | | | 0.494 (4.230) |
| 55-64 | | | -8.732 (5.652) |
| 65 and above | | | --- |
| **Educational Attainment (Population age 25+)** | | | |
| Less than High School Graduation | | | 23.141 (5.996) *** |
| High School Graduate (includes equivalency) | | | 28.244 (4.676) *** |
| Some College, associate's degree | | | 12.752 (4.995) ** |
| Bachelor's Degree or Higher | | | 4.163 (4.185) |
| Controls for State | No | Yes | Yes |
| Controls for Year | No | Yes | Yes |
| Constant | 38.450 (1.752) *** | -1.262 (7.314) | -1105.263 (844.429) |

Notes: Standard Error is reported in parentheses. N=663 in all models. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$ (two-tailed). The following controls were used as reference categories: Native Hawaiian and Other Pacific Islander Alone, Not Hispanic or Latino, and 65 and above. Data is from the years 2010 through to 2022.

**Table 5: Linear Regression Results- Methamphetamine Seizure Rate Regressed on Recreational Cannabis Legalization Status**

| Variables | Model 1 Bivariate | Model 2 + State, Year | Model 3 + Controls |
|---|---|---|---|
| **Explanatory Variable** | | | |
| Legalization Status | -35.601 (11.770) ** | -35.222 (8.025) *** | -10.009 (8.722) |
| **Covariates** | No | No | Yes |
| **Race (Percentage)** | | | |
| White (Alone) | | | -7.294 (2.556) ** |
| Black or African American Alone | | | -32.240 (6.888) *** |
| American Indian and Alaska Native Alone | | | -20.928 (22.823) |
| Asian Alone | | | -16.529 (10.575) |
| Native Hawaiian and Other Pacific Islander Alone | | | --- |
| Some Other Race Alone | | | -0.788 (5.238) |
| **Ethnicity (Percentage)** | | | |
| Not Hispanic or Latino | | | --- |
| Hispanic or Latino (Any Race) | | | -25.979 (5.934) *** |
| **Sex (Percentage)** | | | |
| Male | | | 119.744 (33.555) *** |
| Female | | | --- |
| **Age (Percentage)** | | | |
| 0-9 | | | -9.749 (12.339) |
| 10-14 | | | -7.677 (23.746) |
| 15-19 | | | 41.240 (23.390) |
| 20-34 | | | -0.896 (11.893) |
| 35-54 | | | -14.097 (8.271) * |
| 55-64 | | | 15.912 (11.051) |
| 65 and above | | | --- |
| **Educational Attainment (Population age 25+)** | | | |
| Less than High School Graduation | | | -56.569 (11.724) *** |
| High School Graduate (includes equivalency) | | | -28.125 (9.141) ** |
| Some College, associate's degree | | | -8.973 (9.766) |
| Bachelor's Degree or Higher | | | -50.710 (8.183) *** |
| Controls for State | No | Yes | Yes |
| Controls for Year | No | Yes | Yes |
| Constant | 111.116 (4.571) *** | 47.235 (15.126) ** | -2058.981 (1650.997) |

Notes: Standard Error is reported in parentheses. N=663 in all models. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$ (two-tailed). The following controls were used as reference categories: Native Hawaiian and Other Pacific Islander Alone, Not Hispanic or Latino, and 65 and above. Data is from the years 2010 through to 2022.

**Table 6: Linear Regression Results- Oxycodone Seizure Rate Regressed on Recreational Cannabis Legalization Status**

| Variables | Model 1 Bivariate | Model 2 + State, Year | Model 3 + Controls |
|---|---|---|---|
| **Explanatory Variable** | | | |
| Legalization Status | -10.351 (1.501) *** | 3.255 (1.388) * | 0.786 (1.540) |
| **Covariates** | No | No | Yes |
| **Race (Percentage)** | | | |
| White (Alone) | | | -0.793 (0.451) |
| Black or African American Alone | | | -3.357 (1.216) ** |
| American Indian and Alaska Native Alone | | | -6.225 (4.029) |
| Asian Alone | | | -7.242 (1.867) *** |
| Native Hawaiian and Other Pacific Islander Alone | | | --- |
| Some Other Race Alone | | | -3.240 (0.925) *** |
| **Ethnicity (Percentage)** | | | |
| Not Hispanic or Latino | | | --- |
| Hispanic or Latino (Any Race) | | | -0.519 (1.047) |
| **Sex (Percentage)** | | | |
| Male | | | -16.174 (5.923) * |
| Female | | | --- |
| **Age (Percentage)** | | | |
| 0-9 | | | 1.442 (2.178) |
| 10-14 | | | 8.554 (4.192) * |
| 15-19 | | | -6.647 (4.129) |
| 20-34 | | | 7.254 (2.099) |
| 35-54 | | | 6.040 (1.460) *** |
| 55-64 | | | 9.328 (1.951) *** |
| 65 and above | | | --- |
| **Educational Attainment (Population age 25+)** | | | |
| Less than High School Graduation | | | 14.502 (2.070) *** |
| High School Graduate (includes equivalency) | | | 3.537 (1.614) * |
| Some College, associate's degree | | | -0.082 (1.724) |
| Bachelor's Degree or Higher | | | 0.243 (1.444) |
| Controls for State | No | Yes | Yes |
| Controls for Year | No | Yes | Yes |
| Constant | 13.660 (0.583) *** | 20.079 (2.616) *** | 279.583 (291.441) |

Notes: Standard Error is reported in parentheses. N=663 in all models. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$ (two-tailed). The following controls were used as reference categories: Native Hawaiian and Other Pacific Islander Alone, Not Hispanic or Latino, and 65 and above. Data is from the years 2010 through to 2022.

# References


Bebinger, M. (2019, July 29). *Seizures of methamphetamine are surging in the U.S.* NPR. https://www.npr.org/sections/health-shots/2019/07/29/745061185/seizures-of-methamphetamine-are-surging-in-the-u-s

Bodie, A., Carpenter, D. H., Cilluffo, A. A., Finklea, K., Hegji, A., Johnson, R., Lampe, J. R., Nicchitta, I. A., Rosen, L. W., Sacco, L. N., & Shimabukuro, J. O. (2022, April 7). The evolution of marijuana as a controlled substance and ... https://www.congress.gov/crs-product/R44782

Bryan, K. (2024, June 20). *Cannabis overview*. National Conference of State Legislatures. https://www.ncsl.org/civil-and-criminal-justice/cannabis-overview

Bucco, J. (2024, December 16). *Staying ahead of the law: The importance of police officers keeping up to date with legal changes and updates*. The Blue Magazine. https://www.thebluemagazine.com/new-blog/2024/12/5/staying-ahead-of-the-law-the-importance-of-police-officers-keeping-up-to-date-with-legal-changes-and-updates

*California seizes $534 million in illegal cannabis in 2024*. Governor of California. (2025, March 4). https://www.gov.ca.gov/2025/03/04/california-seizes-534-million-in-illegal-cannabis-in-2024/#:~:text=What%20you%20need%20to%20know,%242.8%20billion%20in%20illegal%20cannabis.

Controlled Substance Act. (n.d.). https://www.isbe.net/CTEDocuments/HST-690026.pdf

Dills, A., Goffard, S., Miron, J., & Partin, E. (2021, February 2). *The effect of state marijuana legalizations: 2021 update*. Cato.org. https://www.cato.org/policy-analysis/effect-state-marijuana-legalizations-2021-update

Finklea, K. (2019, July 3). *Illicit Drug Flows and Seizures in the United States: What Do We [Not] Know?*. Congress.Gov. https://www.congress.gov/crs-product/R45812

Fothergill, K. E., Ensminger, M. E., Green, K. M., Crum, R. M., Robertson, J., & Juon, H.-S. (2008, January 1). *The impact of early school behavior and educational achievement on Adult Drug Use Disorders: A prospective study*. Drug and alcohol dependence. https://pmc.ncbi.nlm.nih.gov/articles/PMC2393553/#:~:text=As%20shown%20in%20Table%204,001

García-Pérez, Á., Aonso-Diego, G., Weidberg, S., & Secades-Villa, R. (2023, May 14). *Testing the cannabis gateway hypothesis in a national sample of Spanish adolescents*. Addictive Behaviors. https://www.sciencedirect.com/science/article/pii/S0306460323001466

Gunadi, C., & Shi, Y. (2022, January). *Cannabis decriminalization and racial disparity in arrests for cannabis possession*. Social science & medicine (1982). https://pmc.ncbi.nlm.nih.gov/articles/PMC9170008/#:~:text=This%20study%20has%20three%20key,(over%2040%25%20reduction)

Harter, C. (2024, October 28). *California's Cannabis Black Market "as big and bad as ever" despite $544m in seizures, sheriffs say*. Police1. https://www.police1.com/drug-

interdiction-narcotics/californias-cannabis-black-market-as-big-and-bad-as-ever-despite-544m-in-seizures-sheriffs-say

*Introduction and trends - methamphetamine drug threat assessment*. National Drug Intelligence Center. (2005, March). https://www.justice.gov/archive/ndic/pubs13/13853/intro.htm#:~:text=According%20to%20state%20and%20local,that%20of%20any%20other%20drug

Kaste, M. (2024, April 5). *Black Market Cannabis thrives in California despite legalization*. NPR. https://www.npr.org/2024/04/05/1242165136/black-market-cannabis-california-legalization-marijuana-recreational-illegal

Leal, W., & Mier, C. (2015, November 18). *What's Age Got to Do With It? Comparing Juveniles and Adults on Drugs and Crime*. Sage Journals. https://journals-sagepub-com.proxy-um.researchport.umd.edu/doi/full/10.1177/0011128715616131

Liu, Y. (Louis), Xie, K., & Chen, W. (2024, August 9). *Recreational Cannabis Legalization and Illicit Drugs: Drug Usage, Mortality, and Darknet Transactions*. Sage Journals. https://journals-sagepub-com.proxy-um.researchport.umd.edu/doi/full/10.1177/10591478241276132

Marples, M. (2022, August 29). *Legalizing recreational cannabis increases its use, research shows*. CNN. https://www.cnn.com/2022/08/29/health/recreational-cannabis-frequent-usage-wellness/index.html

Marshall, L. (2022, November 4). *A decade after legalizing cannabis in Colorado, here's what we've learned*. CU Boulder Today.

https://www.colorado.edu/today/2022/11/04/decade-after-legalizing-cannabis-colorado-heres-what-weve-learned

Marshall, L. (2023, January 24). *"Gateway drug" no more: Study shows legalizing recreational cannabis does not increase substance abuse*. CU Boulder Today. https://www.colorado.edu/today/2023/01/24/gateway-drug-no-more-study-shows-legalizing-recreational-cannabis-does-not-increase

Matthews, A., & Hickey, C. (2024, April 19). *More US states are regulating marijuana. see where it's legal across the country*. CNN. https://www.cnn.com/us/us-states-where-marijuana-is-legal-dg/index.html

Mayet, A., Legleye, S., Beck, F., Falissard, B., & Chau, N. (2015, October 3). *The Gateway Hypothesis, Common Liability to Addictions or the Route of Administration Model A Modeling Process Linking the Three Theories*. National Library of Medicine. https://pubmed.ncbi.nlm.nih.gov/26431216/

Meinhofer , A., & Rubli , A. (2021, May 17). *Illegal drug market responses to State Recreational Cannabis Laws*. Addiction (Abingdon, England). https://pubmed.ncbi.nlm.nih.gov/33998087/

Montgomery, B. W., Athimuthu, P., Richardson, N., & Ray, B. (2025, April 11). *State adult-use cannabis policy effects on law enforcement efforts to disrupt drug markets*. National Library of Medicine. https://pubmed.ncbi.nlm.nih.gov/40220507/

Morral, A. R., McCaffrey, D. F., & Paddock, S. M. (2002). *Using Marijuana May Not Raise the Risk of Using Harder Drugs*. RAND. https://www.rand.org/pubs/research_briefs/RB6010.html

Noel, W., & Wang, J. (2018, November). *Is Cannabis a Gateway Drug? Key Findings and Literature Review*. National Institute of Justice. https://nij.ojp.gov/library/publications/cannabis-gateway-drug-key-findings-and-literature-review

Ortiz, N. R., & Preuss, C. V. (2024, February 9). *Controlled substance act*. StatPearls [Internet]. https://www.ncbi.nlm.nih.gov/books/NBK574544/

Pizzo, L. (2024). *Decriminalization of marijuana: EBSCO*. EBSCO Information Services, Inc. | www.ebsco.com. https://www.ebsco.com/research-starters/law/decriminalization-marijuana

Preuss, C. V., Kalava, A., & King, K. C. (2023, April 29). *Prescription of controlled substances: Benefits and risks*. StatPearls [Internet]. https://www.ncbi.nlm.nih.gov/books/NBK537318/

Rogers, L. S. (2023, August 25). *Risks and benefits of legalized cannabis*. Johns Hopkins Bloomberg School of Public Health. https://publichealth.jhu.edu/2023/risks-and-benefits-of-legalized-cannabis

Rosenberg, A., Groves, A. K., & Blankenship, K. M. (2016, December 21). *Comparing black and white drug offenders: Implications for racial disparities in criminal justice and*

*reentry policy and programming*. Journal of drug issues. https://pmc.ncbi.nlm.nih.gov/articles/PMC5614457/

Secades-Villa, R., Garcia-Rodríguez, O., Jin, C. J., Wang, S., & Blanco, C. (2015, February). *Probability and predictors of the Cannabis Gateway Effect: A National Study*. The International journal on drug policy. https://pmc.ncbi.nlm.nih.gov/articles/PMC4291295/

Stohr, M. K., Willits, D. W., Makin, D. A., Hemmens, C., Lovrich , N. P., Stanton, D. L., & Meize, M. (2020, June). *Effects of marijuana legalization on Law Enforcement and Crime: Final Report*. National Institute of Justice. https://nij.ojp.gov/library/publications/effects-marijuana-legalization-law-enforcement-and-crime-final-report

Svrakic, D. M., Lustman, P. J., Mallya, A., Lynn, T. A., Finney, R., & Svrakic, N. M. (2012). *Legalization, Decriminalization & Medicinal Use of cannabis: A scientific and public health perspective*. Missouri Medicine. https://pmc.ncbi.nlm.nih.gov/articles/PMC6181739/

U.S. Department of Health and Human Services. (2020, April 1). *Sex differences in substance use*. National Institutes of Health. https://nida.nih.gov/publications/research-reports/substance-use-in-women/sex-differences-in-substance-use

*United States: US CBP seizures of methamphetamine more than doubled within only 2 years*. UNODC Laboratory and Scientific Service Portals. (2021, January).

https://www.unodc.org/LSS/announcement/Details/797ed568-9c76-4b11-a544-3a71ed99ab09

*(U) National Heroin Threat Assessment Summary - updated*. DEA. (2016, June). https://www.dea.gov/sites/default/files/2018-07/hq062716_attach.pdf

Xing, J., & Shi, Y. (2024, September 4). *Cannabis consumers' preferences for legal and illegal cannabis: Evidence from a discrete choice experiment - BMC public health*. BioMed Central. https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-024-19640-1#citeas